Allison Transmission®

Mechanic's Tips

MD/HD/B Series

Allison On-Highway Transmissions

MT2159EN

Mechanic's Tips

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Allison Transmission

Allison On-Highway WTEC II Controls MD, HD, B Series

3000 Series (except 3070)
4000 Series
B 300 Series
B 400 Series
B 500 Series

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NOTES

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TRADEMARK USAGE

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WARNINGS, CAUTIONS, NOTES

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions described in this handbook. It is, however, important to understand that these warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. The vehicle manufacturer is responsible for providing information related to the operation of vehicle systems (including appropriate warnings, cautions, and notes). Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION OR THE VEHICLE MANUFACTURER MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods selected.

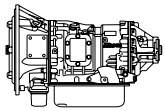
Proper service and repair is important to the safe, reliable operation of the equipment. The service procedures recommended by Allison Transmission (or the vehicle manufacturer) and described in this handbook are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

Three types of headings are used in this manual to attract your attention. These warnings and cautions advise of specific methods or actions that can result in personal injury, damage to the equipment, or cause the equipment to become unsafe.

WARNING: A warning is used when an operating procedure, practice, etc., if not correctly followed, could result in personal injury or loss of life.

CAUTION: A caution is used when an operating procedure, practice, etc., if not strictly observed, could result in damage to or destruction of equipment.

NOTE: A note is used when an operating procedure, practice, etc., is essential to highlight.



INTRODUCTION

Section I

1–1. ABOUT THIS MANUAL

This handbook is a mechanic's reference for maintaining, removing, or installing the MD/HD Product Line on-highway transmissions with the WTEC II control system.

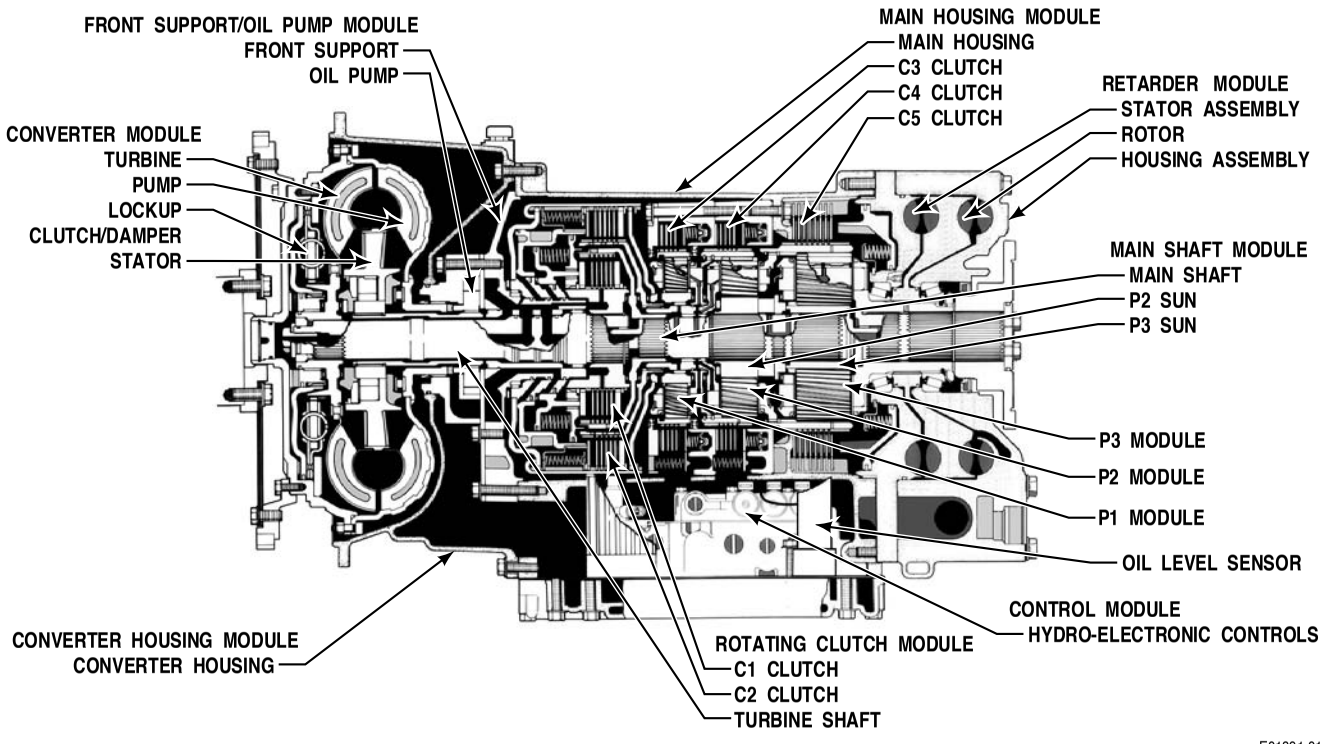
All features of the transmission and the vehicle involved in installation procedures are discussed. The information will help the mechanic maintain, remove, or install the transmission in a manner that assures satisfactory operation and long service life. For additional detailed information, refer to Section 8–2, Service Literature, Table 8–1, for the appropriate transmission service manual and electronic control troubleshooting manual.

Unless specifically indicated otherwise, this handbook refers to all MD/HD Product Line transmissions, except MD 3070. The differences between the various transmissions in this product line are explained as required.

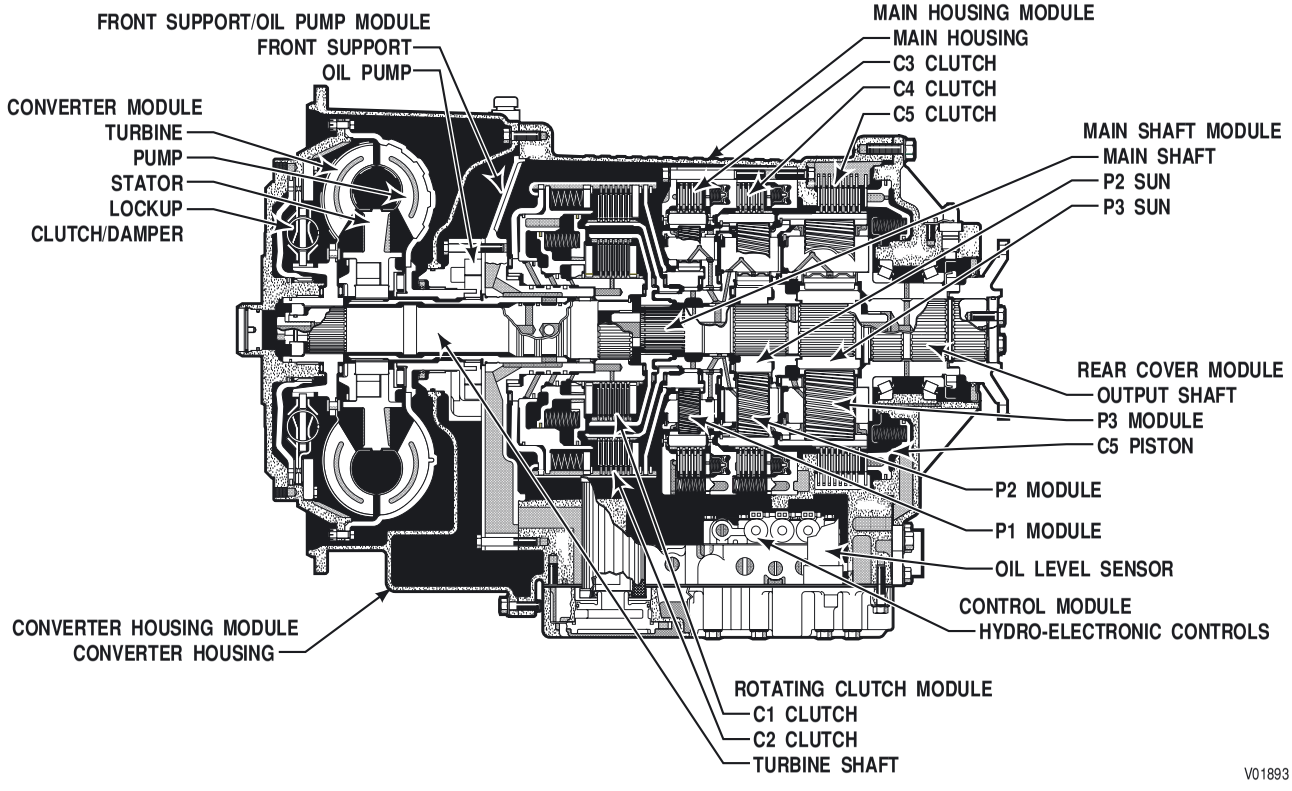
Table 1–1. Abbreviations

AT	Allison Transmission
ECU	Electronic Control Unit
EMI	Electromagnetic interference
FCC	Federal Communications Commission
KOH	Potassium Hydroxide
MD/HD Product Line	MD, HD, B Series transmissions
MIL	Military specifications
OEM	Original equipment manufacturer
OLS	Oil level sensor
PTO	Power Takeoff
RFI/EMI	Radio frequency interference/electromagnetic interference
TAN	Total acid number
TIR	Total indicated runout
TPS	Throttle position sensor
VIM	Vehicle interface module

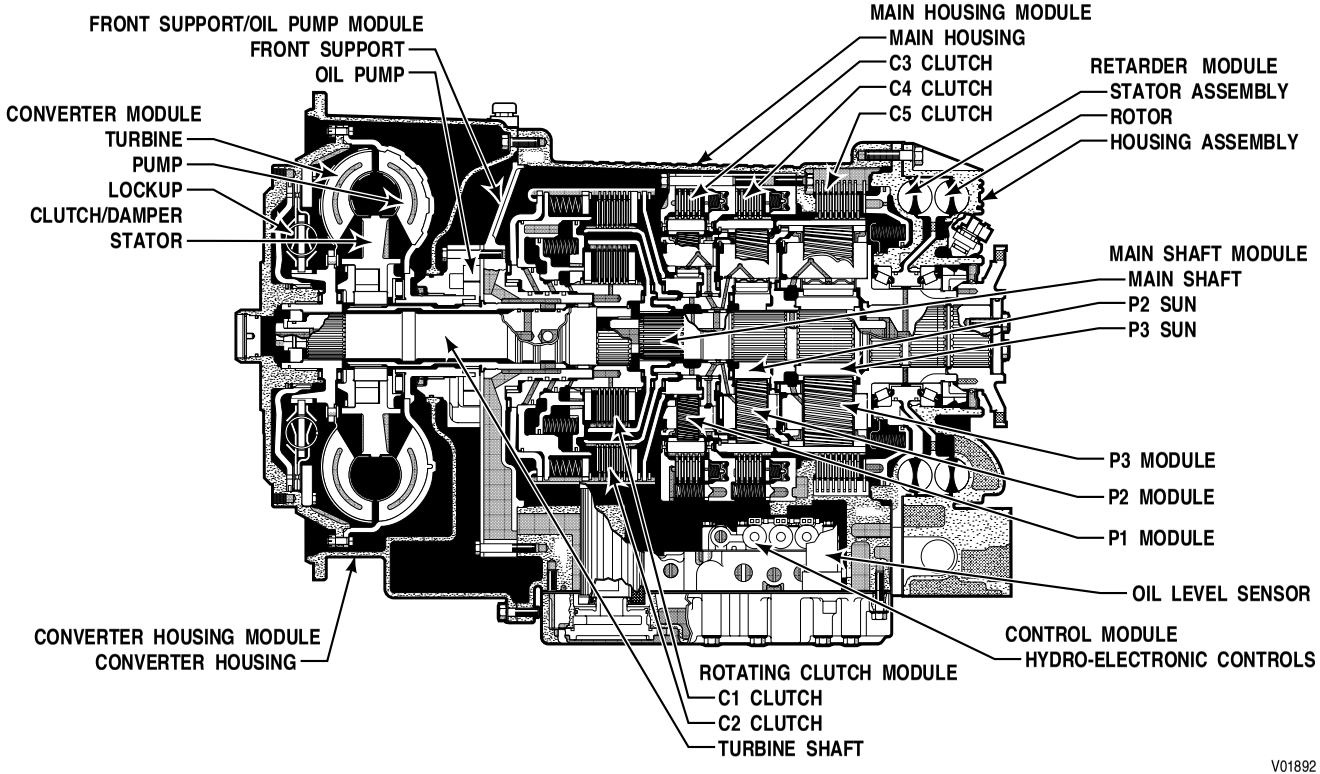
MD 3060R/B 300R/B 400R TRANSMISSION CROSS SECTION



HD/B 500 TRANSMISSION — CROSS SECTION



HD/B 500R TRANSMISSION CROSS SECTION



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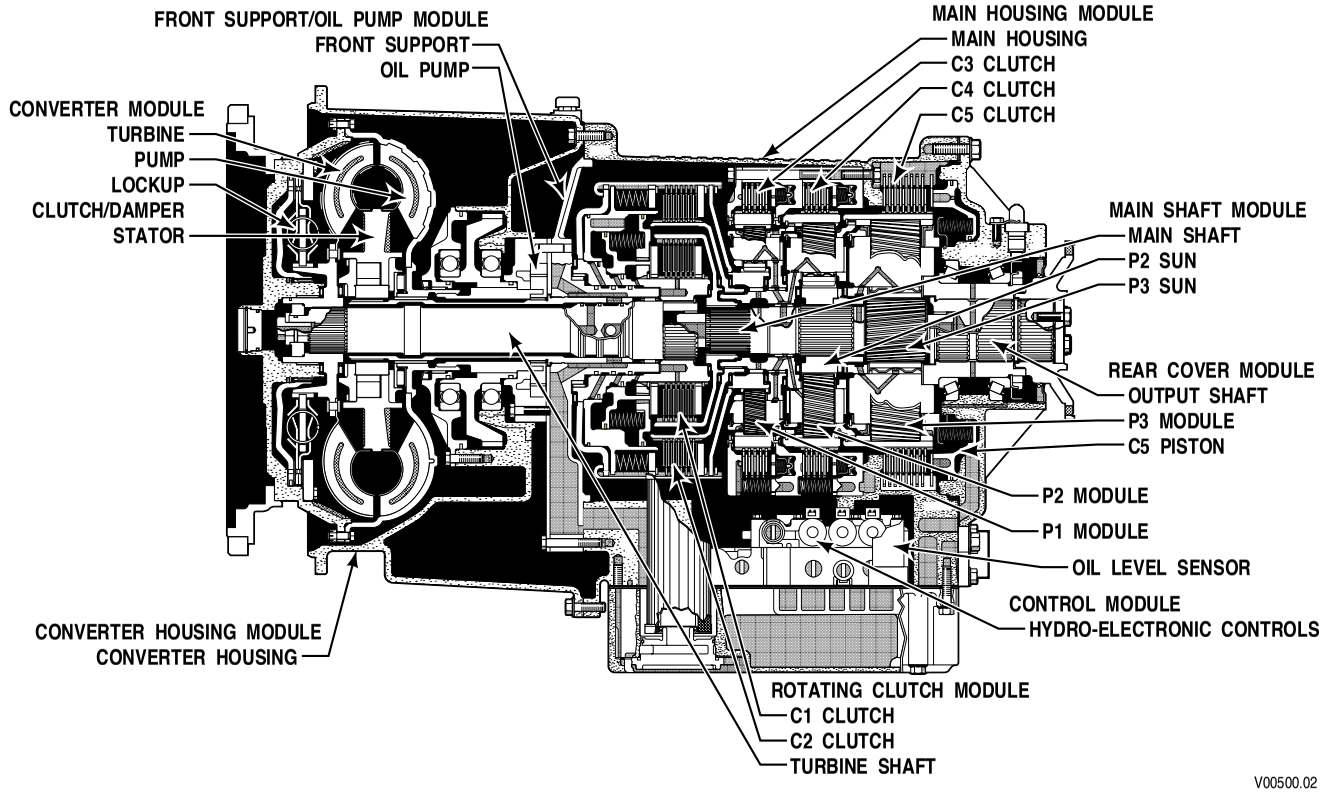
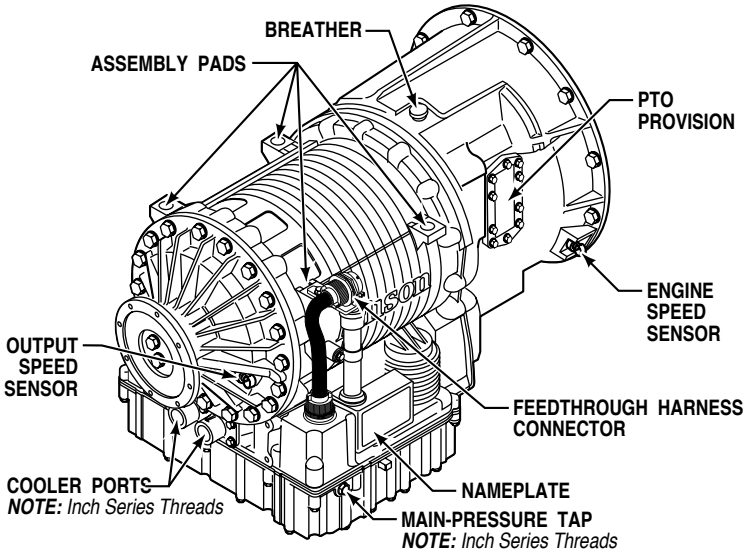
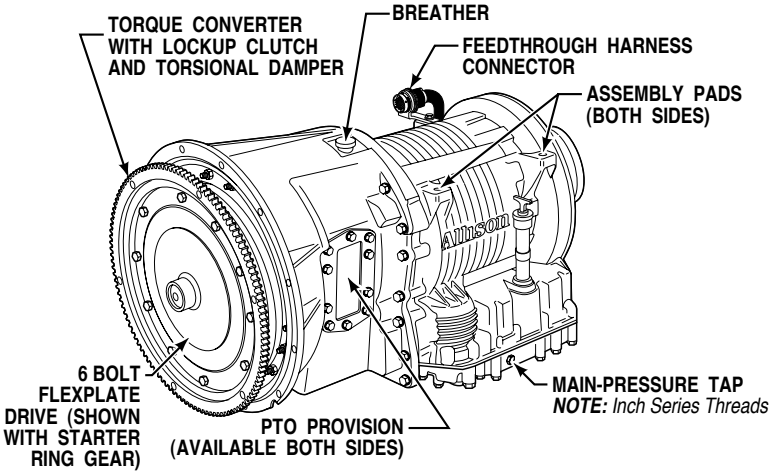




MD/B 300P/B 400P RIGHT-REAR VIEW



MD/B 300P/B 400P LEFT-FRONT VIEW

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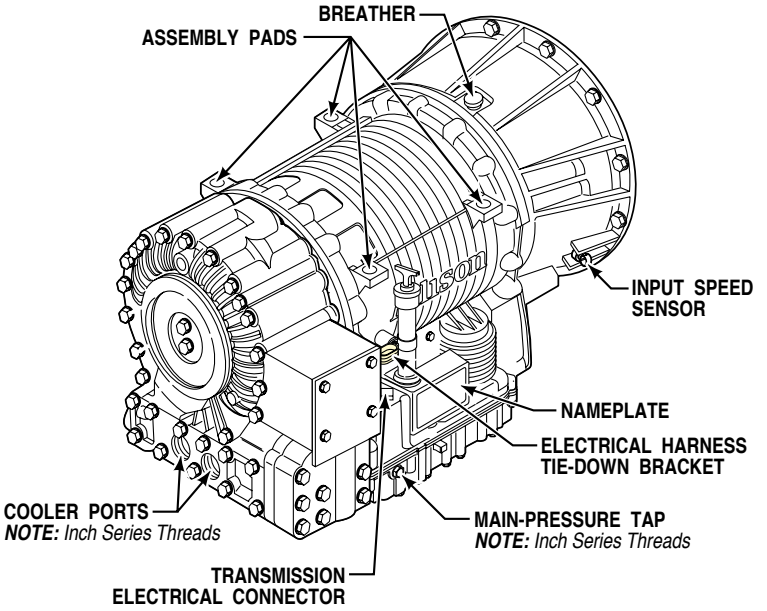
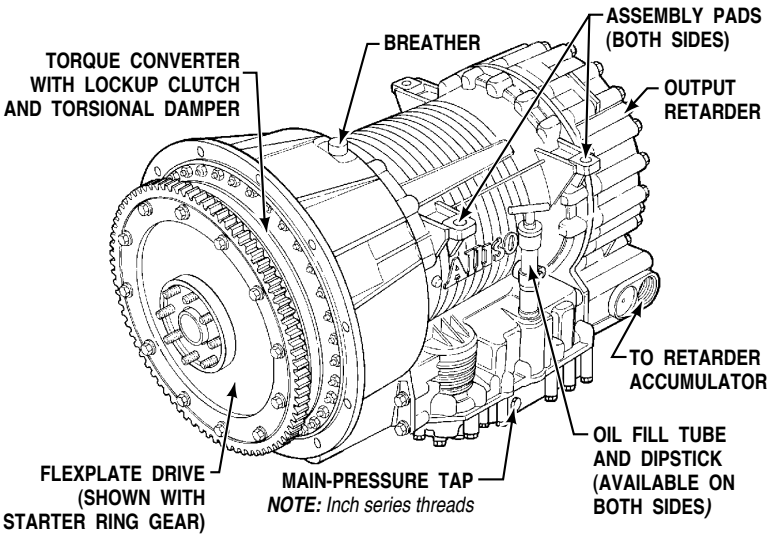


MD/B 300R/B 400R RIGHT-REAR VIEW



MD/B 300R/B 400R LEFT-FRONT VIEW

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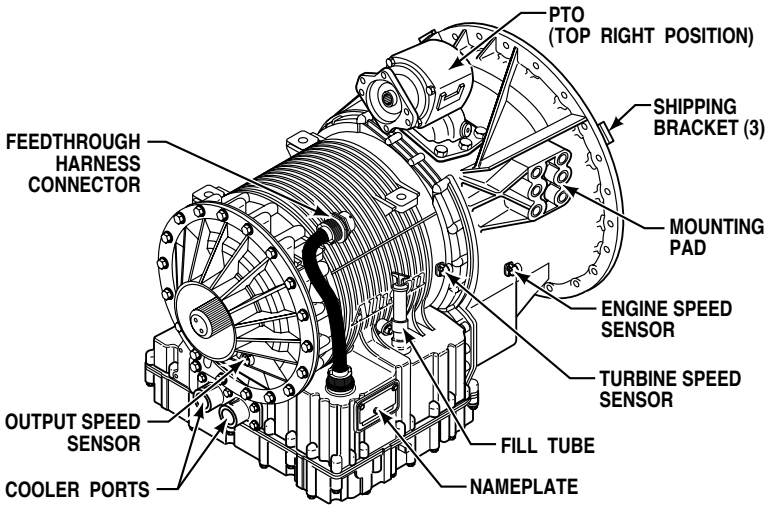
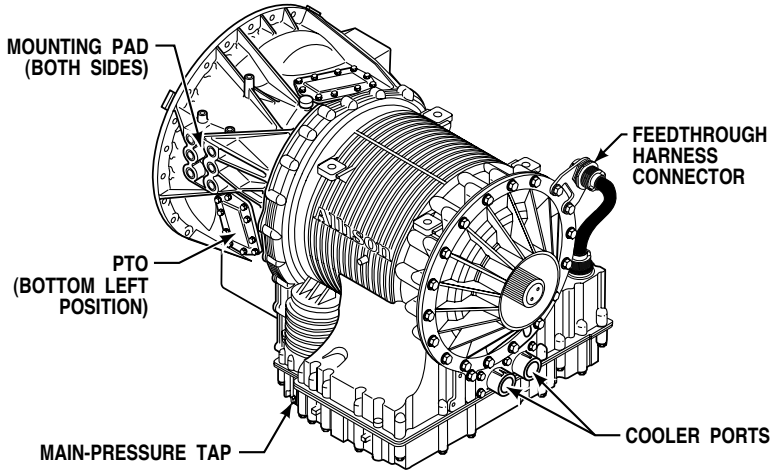


B 500P RIGHT-REAR VIEW



B 500P LEFT-REAR VIEW

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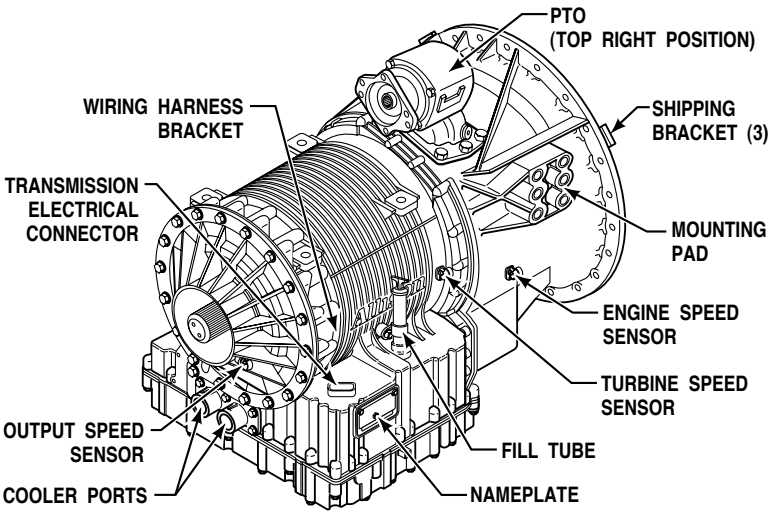
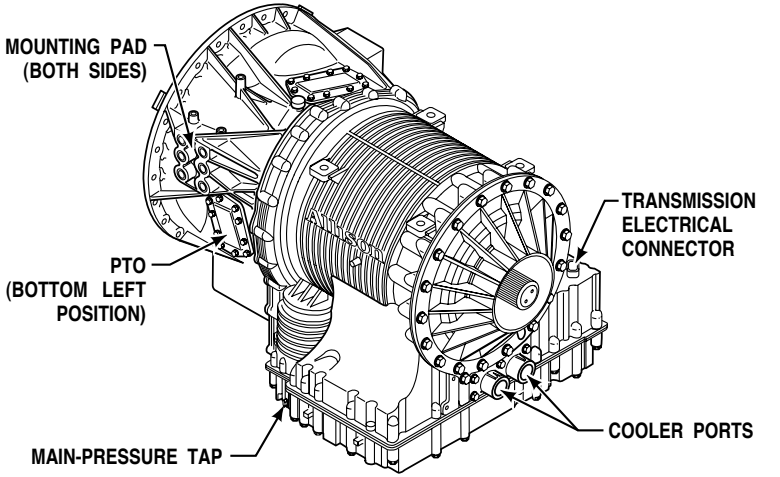


HD 4060P/4560P RIGHT-REAR VIEW



HD 4060P/4560P LEFT-REAR VIEW

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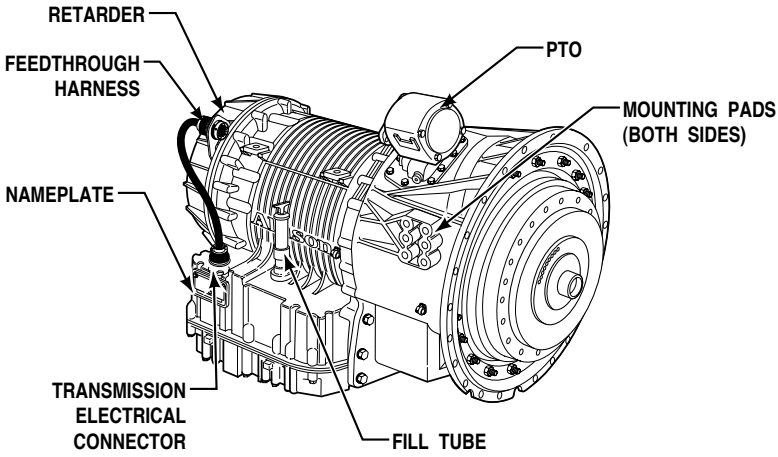
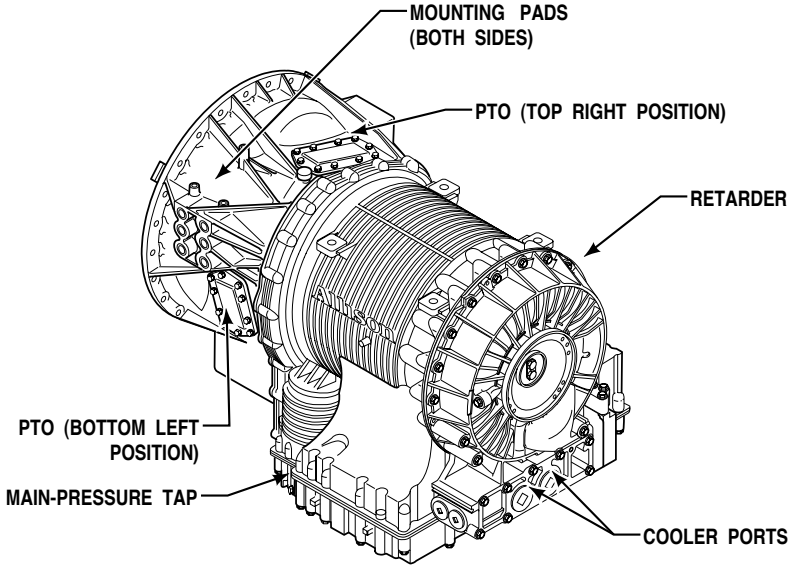


HD 4060PR/4560PR RIGHT-FRONT VIEW



HD 4060PR/4560PR LEFT-REAR VIEW

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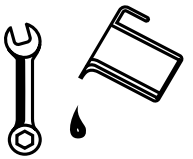
Section II	PREVENTIVE MAINTENANCE	

2–1. PERIODIC INSPECTION AND CARE

Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operating conditions determine the frequency of these inspections. Inspect the transmission for:

- Loose bolts—transmission and mounting components
- Fluid leaks—repair immediately
- Loose, dirty, or improperly adjusted throttle sensor
- Damaged or loose hoses
- Worn, frayed, or improperly routed electrical harnesses
- Worn or out-of-phase driveline U-joints and slip fittings
- Clogged or dirty vent (breather)
- Check the vehicle cooling system for evidence of transmission fluid. Transmission fluid in the vehicle cooling system indicates a faulty oil cooler.

CAUTION: When welding on the vehicle:
- DO NOT WELD on the vehicle without disconnecting all control system wiring harness connectors from the ECU.
- DO NOT WELD on the vehicle without disconnecting ECU battery power and ground leads.
- DO NOT WELD on any control components.
- DO NOT CONNECT welding cables to any control components.
- PROTECT CONTROL COMPONENTS FROM SPARKS AND HEAT DURING WELDING.

A label describing on-vehicle welding precautions is available from authorized Allison service dealers and should be installed in a conspicuous place. A vehicle used in a vocation that requires frequent modifications or repairs involving welding **must have** an on-vehicle welding label (ST2067EN).

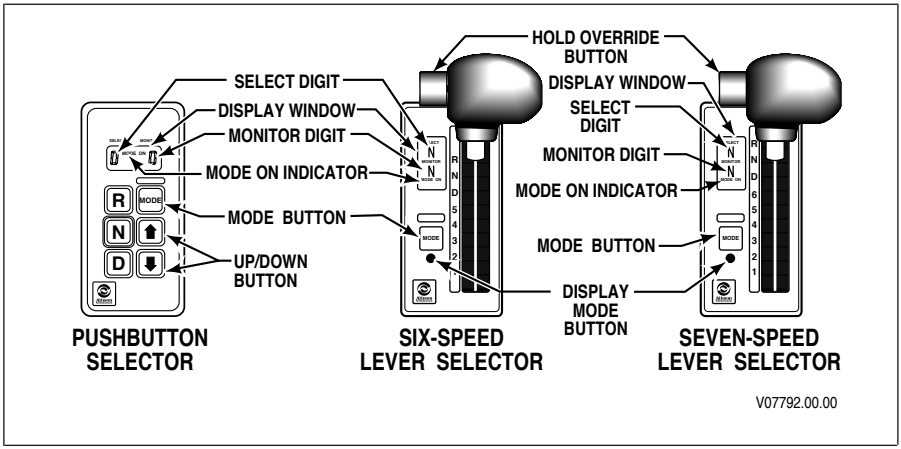


Figure 2–1. Shift Selectors

2–2. IMPORTANCE OF PROPER TRANSMISSION FLUID LEVEL

Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain proper fluid level.

If fluid level is too low, the torque converter and clutches do not receive an adequate supply of fluid and the transmission overheats.

If the level is too high, the fluid aerates, causing erratic shifts, overheating, and exhausting of fluid through the breather or dipstick tube.

2–3. TRANSMISSION FLUID CHECK

a. Electronic Fluid Check Procedure. Fluid level information may be displayed on the shift selector (Figure 2–1) if the transmission being maintained has an oil level sensor (OLS). If the transmission does not have an OLS, refer to Paragraph b. Manual Fluid Check Procedure in this Section.

- Displaying fluid level information:
  - — For a pushbutton shift selector, simultaneously press the ↑ **(Up)** and ↓ **(Down)** arrow buttons once.
  - — For a lever shift selector, press the **DISPLAY MODE/DIAGNOSTIC** button once.
- Fluid Level Mode. A two minute countdown begins after entering fluid level mode. The display flashes and an 8, 7, ...1 countdown occurs. Fluid level information displays after the countdown if the following conditions have been met:
  - — Engine is at idle.

— Sump fluid is at operating temperature between 60–104°C (140–220°F).

— Transmission output shaft has stopped.

— Transmission is in **N** (Neutral)

— Oil level sensor is functioning properly

- Shift Selector Display. After two minutes the shift selector will display the fluid level data according to Table 2–1, Fluid Level Shift Selector Display.

Table 2–1. Fluid Level Shift Selector Display

Code	Interpretation of Display
OL OK OK	Fluid level is correct
OL LO 01	Fluid level is one quart low—or as many quarts as indicated (maximum readout is “03”)
OL HI 01	Fluid level is one quart high—or as many as indicated (maximum readout is “03”)

The shift selector can only display two characters at a time. One character is displayed under the MONITOR label and one under the SELECT label. The fluid information is sequentially displayed according to Table 2–2, Fluid Level Displays.

Table 2–2. Fluid Level Displays

	SELECT	MONITOR
If fluid level is correct	O	L
	O	K
	O	K
If fluid is low	O	L
	L	O
	O	1
If fluid is high	O	L
	H	I
	5	1

NOTE: Failure to meet any of the above conditions stops the two minutes countdown. Refer to Table 2–3, Countdown Interruption Codes, for the codes displayed on the shift selector showing the reasons for the countdown interruption. When all conditions have been met, the countdown will resume where it stopped.

Table 2–3. Countdown Interruption Codes

Code	Cause of Code
OL 50	Engine rpm too low
OL 59	Engine rpm too high
OL 60	Neutral
OL 70	Sump fluid temperature too low
OL 79	Sump fluid temperature too high
OL 89	Output shaft rotation
OL 95	Sensor failure: — Engine — Output speed — Temperature — Fluid level

If fluid level cannot be checked and a code is issued indicating the reason, refer to Table 2–4, Codes Indicating Fluid Level Check Failure.

Table 2–4. Codes Indicating Fluid Level Check Failure

Select	Monitor
O	L
—	—
5	9

NOTE: Report sensor failure to a distributor or dealer. Consult the telephone directory or Allison website, www.allisontransmission.com, for an Allison Transmission distributor or dealer.

- Exiting the Fluid Level Display Mode:
  - — For a pushbutton shift selector, press any range selection button.
  - — For a lever selector, press the **DISPLAY MODE** button once or select a range.

b. Manual Fluid Check Procedure. Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow dirt or foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages. Check the fluid level using the following procedure and report any abnormal fluid levels to your maintenance persons.

WARNING: Avoid injury and/or property damage caused by unexpected vehicle movement by doing the following when checking transmission fluid level:

- Put the transmission in **N** (Neutral).
- Apply the parking brake, emergency brakes, and make sure they are properly engaged.
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.

c. Cold Check Procedure. The purpose of the cold check is to determine if the transmission has enough fluid to be safely operated until a hot check can be made.

CAUTION: DO NOT fill the transmission above the "COLD RUN" band if the transmission fluid is below normal operating temperatures. During operation, an overfull transmission can become overheated, leading to transmission damage.

- Park the vehicle on a level surface. Apply the parking brake and chock the wheels.
- Run the engine for at least one minute. Shift to **D** (Drive) then to **N** (Neutral), and then shift to **R** (Reverse) to fill the hydraulic system. Shift to **N** (Neutral) and allow the engine to idle (500–800 rpm).
- With the engine running, remove the dipstick from the tube and wipe it clean.
- Insert the dipstick into the tube until it stops and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
- If the fluid level is within the "COLD RUN" band, the transmission may be operated until the fluid is hot enough to perform a "HOT RUN" check.
- If the fluid level is not within the "COLD RUN" band, add or drain as necessary to bring it to the middle of the "COLD RUN" band.
- Perform a hot check at the first opportunity after the normal operating sump temperature of 71°C–93°C (160°F–200°F) is reached.

d. Hot Check Procedure.

CAUTION: The fluid **must be hot** to be sure of an accurate check. Fluid level rises as temperature increases.

- Operate the transmission in **D** (Drive) until normal operating temperatures are reached:
  - — sump temperature 71°C–93°C (160°F–200°F)
  - — converter-out temperature 82°C–104°C (180°F–220°F)
- Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake and/or emergency brakes and chock the wheels. Allow the engine to idle (500–800 rpm).
- With the engine running, remove the dipstick from the tube and wipe clean.
- Insert the dipstick into the tube until it stops and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

NOTE: Safe operating level is within the "HOT RUN" band on the dipstick. The "HOT RUN" band is between the "HOT FULL" and the "HOT ADD" bands. Refer to Figure 2–2.

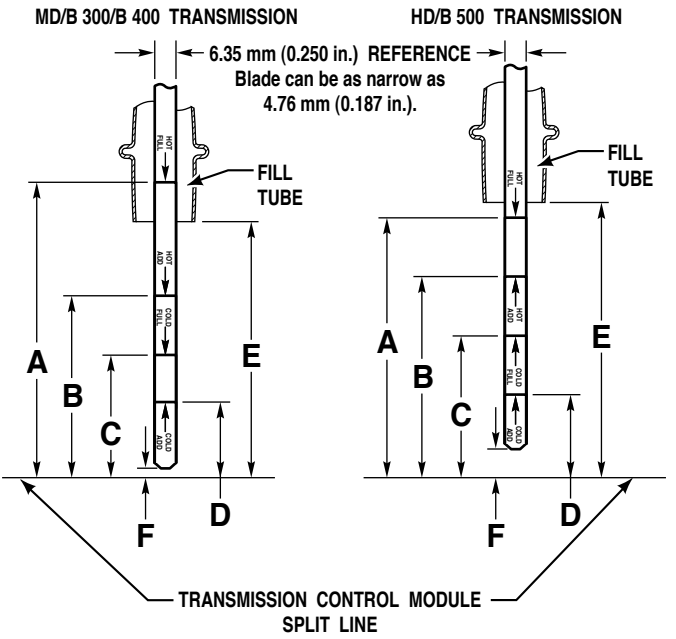
- If the fluid level is not within the "HOT RUN" band, add or drain as necessary to bring the fluid level to within the "HOT RUN" band. Refer to Figure 2–2, Standard MD/HD Product Line Dipstick Markings.

e. Consistency of Readings. Always check the fluid level at least twice, with the engine running. Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, check the transmission breather to be sure it is clean and unclogged.

2–4. KEEPING FLUID CLEAN

Prevent foreign material from entering the transmission by using clean containers, fillers, etc. Lay the dipstick in a clean place while filling the transmission.

CAUTION: Containers or fillers that have been used for antifreeze solution or engine coolant must NEVER be used for transmission fluid. Antifreeze and coolant solutions contain ethylene glycol which, if put into the transmission, can cause the clutch plates and some seals to fail.



OIL SUMP	TRANSMISSION/SUMP DESCRIPTION	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION E	DIMENSION F**
N/A	All HD/B 500	106.7 mm (4.20 in.)	76.2 mm (3.00 in.)	66.0 mm (2.60 in.)	*	132.6 mm (5.22 in.)	13.8 mm (0.54 in.)
2.00 in.***	B 300/B 400 "STANDARD"	101.6 mm (4.00 in.)	73.7 mm (2.90 in.)	50.8 mm (2.00 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
4.00 in.***	B 300/B 400 "DEEP OPTIONAL"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
2.00 in.***	MD 3060/3560 "SHALLOW OPTIONAL"	101.6 mm (4.00 in.)	73.7 mm (2.90 in.)	50.8 mm (2.00 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
4.00 in.***	MD 3060/3560 "STANDARD"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
7.00 in.***	MD 3070PT "STANDARD"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)

NOTE: *Calibrate level marking locations with respect to transmission control module split line and fill tube.*
Scale none.
**Dimension determined by installation.*
***Reference dimension only. Actual dimension to be determined by installation.*
****Reference drawing AS66-60.*
*****Reference drawing AS67-60.*

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Figure 2–2. Standard MD/HD Product Line Dipstick Markings

2–5. FLUID RECOMMENDATIONS

The hydraulic fluid used in the transmission is an important influence on transmission performance, reliability, and durability. DEXRON®-III and TranSynd™ fluids are recommended for use in the MD/HD Product Line transmissions.

Some DEXRON®-III fluids are also qualified as Type C4 fluids. To be sure the fluid is qualified for use in Allison transmissions, do the following:

- Check for a DEXRON®-III or C4 fluid license or approval number on the container.
- Refer to the approved fluid list on the Allison Transmission website, www.allisontransmission.com.
- Consult the lubrication manufacturer.

TranSynd™ is a full synthetic transmission fluid developed by Allison Transmission and Castrol Ltd. This fluid meets Allison Transmission specifications for Severe Duty and Extended Drain Intervals. TranSynd™ is fully qualified to meet the GM DEXRON®-III or C4 specifications and is available through Allison Transmission distributors and dealerships. Transmissions that have factory fill TranSynd™ can be identified by the transmission name tag on the side of the main case showing date code 02A02 (02 = year, A = January, 02 = day) or later This code will also confirm MD/HD Product Line transmissions that have been equipped with the high capacity “Gold Seal” main and lube oil filter.

CAUTION: Disregarding minimum fluid temperature limits can result in transmission malfunction or reduced transmission life.

When choosing the optimum viscosity grade of fluid to use, the following **must be** taken into consideration:

- Duty cycle
- Preheat capabilities
- Geographic location.

Table 2–5, Transmission Fluid Operating Temperature Requirements, lists the minimum fluid temperatures at which the transmission may be safely operated without preheating the fluid. Preheat with auxiliary heating equipment or by running the equipment or vehicle with the transmission in **N** (Neutral) for a minimum of 20 minutes before attempting range operation.

Table 2–5. Transmission Fluid Operating Temperature Requirements

SAE Viscosity Grade*	Minimum Operating Temperature	
	Celsius	Fahrenheit
MIL-PRF-46167	–32	–25
SAE 0W-20 or TranSynd™	–30	–22
DEXRON®-III	–25	–13
SAE 10W	–20	–4
SAE 15W-40	–15	5
SAE 30W	0	32
SAE 40W	10	50
* SAE "W" designation indicates winter weight based on cold temperature properties.		

2–6. TRANSMISSION FLUID AND FILTER CHANGE INTERVALS

a. Frequency. Optimum performance and reliability of heavy-duty automatic transmissions can be noticeably influenced by the type of fluid used and the frequency with which the fluid is changed. Allison Transmission has designed extensive programs including specifications and tests to verify the quality of fluids and consequently have specific fluid and filter change recommendations.

NOTE: Local conditions, severity of operation, or duty cycle may require more frequent or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission.

With the introduction of the "Gold Series" filters for the MD/HD Product Line transmissions, the initial 5000 miles (8000 km/200 hours) filter change interval has been modified to require changing the main filter only.

Table 2–6 and Table 2–7 list current fluid and filter change recommendations based on vocation. If fluid change intervals are extended by fluid analysis, transmission filters **must be** changed at or before recommended filter change intervals. Refer to Allison Transmission publication number GN2055EN, Technicians' Guide to Automatic Transmission Fluid, for additional information on fluid analysis and general knowledge about engine oils and transmission fluids.

NOTE: Transmission protection and fluid change intervals can be optimized by the use of fluid analysis. However, filters must be changed at or before recommended intervals.

Table 2–6. Recommended Fluid/Filter Change For MD/B 300/B 400 Series Transmissions*

SEVERE VOCATION**				GENERAL VOCATION***			
	Filters				Filters		
Fluid	Main	Internal	Lube/ Auxiliary	Fluid	Main	Internal	Lube/ Auxiliary
Schedule 1 — Non-TranSynd™/Non-TES 295 Fluid							
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours
Schedule 2† — TranSynd™/TES 295 Fluid††							
75,000 Miles (20 000 km) 6 Months 3000 Hours	75,000 Miles (20 000 km) 6 Months 3000 Hours	Overhaul	75,000 Miles (20 000 km) 6 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	75,000 Miles (20 000 km) 6 Months 3000 Hours	Overhaul	75,000 Miles (20 000 km) 6 Months 3000 Hours

* Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever comes first.

** All retarders, on/off highway, refuse, transit, and intercity coach with duty cycle greater than one (1) stop per mile.

*** Intercity coach with duty cycle less than or equal to one (1) per mile and all other vocations.

† Recommendations in Schedule 2 are based on the transmission containing 100%TranSynd™ fluid and Allison Transmission Gold Series filters.

†† Flushing machines are not recommended or recognized due to variations and inconsistencies with 100% removal of used fluid.

Table 2–7. Recommended Fluid/Filter Change For HD/B 500 Series Transmissions*

SEVERE VOCATION**				GENERAL VOCATION***			
	Filters				Filters		
Fluid	Main	Internal	Lube/ Auxiliary	Fluid	Main	Internal	Lube/ Auxiliary
Schedule 1 — Non-TranSynd™/Non-TES 295 Fluid							
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours
Schedule 2† — TranSynd™/TES 295 Fluid†† **4 Inch Control Module (3.5 Inch Approximately) — Requires Filter Kit P/N 29540494**							
75,000 Miles (120 000 km) 36 Months 3000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours
Schedule 3† — TranSynd™/TES 295 Fluid **2 Inch Control Module (1.75 Inch Approximately) — Requires Filter Kit P/N 29540493**							
50,000 Miles (80 000 km) 24 Months 2000 Hours	50,000 Miles (80 000 km) 24 Months 2000 Hours	Overhaul	50,000 Miles (80 000 km) 24 Months 2000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	50,000 Miles (80 000 km) 24 Months 2000 Hours	Overhaul	50,000 Miles (80 000 km) 24 Months 2000 Hours

* Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever comes first.

** All retarders, on/off highway, refuse, transit, and intercity coach with duty cycle greater than one (1) stop per mile.

*** Intercity coach with duty cycle less than or equal to one (1) per mile and all other vocations.

† Recommendations in Schedules 2 and 3 are based on the transmission containing 100% TranSynd™ fluid and Allison Transmission Gold Series filters.

†† Flushing machines are not recommended or recognized due to variations and inconsistencies with 100% percent removal of used fluid.

b. Abnormal Conditions. Transmission fluid **must be** changed whenever there is evidence of dirt or high temperature. A high temperature condition is indicated by transmission fluid:

- Discoloration
- Strong odor
- Fluid analysis.

The frequency of fluid and filter change is determined by:

- Local conditions
- Severity of operation
- Duty cycle.

c. Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid conditions according to the tests and limits shown in Table 2–8, Fluid Oxidation Measurement Limits. Consult the local telephone directory for fluid analysis firms. Use only one fluid analysis firm to be sure of consistent and accurate analysis results. Refer to Allison Transmission publication number GN2055EN, Automatic Transmission Fluid Technician's Guide, for additional information.

Table 2–8. Fluid Oxidation Measurement Limits

Test	Limit
Viscosity	±25 percent change from new fluid
Total Acid Number (TAN)	+3.0* change from new fluid
* mg of potassium hydroxide (KOH) to neutralize a gram of fluid.	

Limits are referenced from an unused fluid sample. Collect a new, unused fluid sample and submit it for analysis when beginning fluid analysis or repurchasing bulk fluid stock such as a 55 gallon drum or larger.

Viscosity and total acid number (TAN) values measured from an unused sample create the baseline against which future used fluid samples will be measured.

2–7. TRANSMISSION FLUID CONTAMINATION

a. Monitoring Contaminant Levels. The presence of fluid contaminants in an automatic transmission can be detrimental to continued operation. Contaminant limits are shown in Table 2–9, Contaminant Limits. Examine the fluid at each fluid and/or filter change for contaminants.

Table 2–9. Contaminant Limits

Contaminant	Limit
Water	0.2% maximum
Glycol	No trace allowed
Alien fluids*	If detected, change transmission fluid
* Any fluid not included on the Allison C4 Approved Fluids List. The Approved Fluids List may be found at Allison Transmission website, www.allisontransmission.com.	

b. Monitoring Wear. Absolute maximum values cannot be applied to wear metals of an automatic transmission due to the many variables present that affect concentration limits. Wear metal analysis results **must be** evaluated using a trendline approach.

A trendline approach plots the concentration level of each wear metal over a period of time. A minimum of four data points for each metal is required to establish a trendline. A line of "best fit"drawn through the plotted points is considered a trendline. Cause for concern should only occur when significant deviations in the established trendline are present.

While trendline analysis on wear metals can prove informative and useful, a transmission removal decision should not be based solely upon the analysis. A removal based solely on wear metal analysis may result in an unnecessary tear down. The results should be used in conjunction with other inspection procedures such as functional check, road test, or fluid sump/internal filter inspection. Transmission removal should occur only if the additional investigation warrants it.

c. Water/Engine Coolant Contaminant. The presence of water and/or ethylene glycol coolant mixture in the transmission fluid is detrimental to the reliability and durability of the internal components. Contaminated fluid has a deteriorating effect on the transmission components. Frictional capacity of drive clutch plates can be greatly reduced as a result of surface film or impregnation and the presence of glycol will physically deteriorate clutch plate materials.

If contamination is suspected, a fluid sample should be obtained when transmission fluid is at normal operating temperature to be sure a contaminant, if present, is thoroughly dispersed in the fluid being sampled. The analysis of the sample, by the fluid supplier or any qualified laboratory, will provide the degree of contamination and possibly a clue as to its source. A minimal amount of water and glycol may be due to one or all of the following:

- Uncovered oil drums
- Open transmission fill tube
- Glycol from an all-purpose fill container
- Defective transmission oil cooler.

Fluid contamination greater than 0.2 percent water by volume, regardless of whether it contains glycol, is considered contaminated and should not be used.

CAUTION: If the transmission fluid is contaminated by water, 0.2 percent by volume, or any trace of ethylene glycol, disassemble the transmission and replace the following:

- Seals
- Gaskets
- Clutch plates
- Bearings
- Torque converters that cannot be disassembled
- Components that have rusted
- Solenoids that do not meet resistance specifications

Remove all traces of ethylene glycol and varnish deposits. Failure to follow this procedure decreases transmission reliability and durability.

Nelco Company offers a kit that detects presence of ethylene glycol in transmission fluid. The kit is identified as “GLY-TEK” Test Kit and can be obtained from:

Nelco Company
1047 McKnight Road South
Saint Paul, Minnesota 55119
(651) 738–2014

Some conditions that may indicate water and/or glycol in the fluid are:

- Rust or pitted transmission parts
- Transmission fluid spewing out of transmission breather
- Transmission fluid in radiator
- Gaskets blistered or wrinkled in uncompressed areas
- Appearance of fluid (presence of water in the fluid when dispersed is a cloudy or gray, pink, or strawberry color)
- Steam from the breather.

For additional information on field analysis, refer to Allison Transmission publication number GN2055EN, Automatic Transmission Fluid Technician’s Guide. This publication can be used to reference testing methods and limits for water/glycol content.

2–8. TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE

a. Drain Fluid.

NOTE: Do not drain transmission fluid if only the filters are being replaced.

1. Drain the fluid when the transmission is at normal operating sump temperature, 71°C–93°C (160°F–200°F). Hot fluid flows faster and drains more completely.
2. Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.
3. Examine the fluid as described in Section 2–7, TRANSMISSION FLUID CONTAMINATION, Paragraph a. Monitoring Contaminant Levels, Paragraph b. Monitoring Wear, and Paragraph c. Water/Engine Coolant Contaminant.

b. Standard Fluid/Filter Change Procedure (Figure 2–3).

- MD/B 300/B 400 Series transmissions before S/N 6510069120 and HD/B 500 before S/N 6610009730:
  1. Remove twelve bolts 1, two filter covers 2, two square-cut seals 4, two o-rings 5, and two filters 6 from the bottom of the control module.
  2. Lubricate and install two new o-rings 5.
  3. Install a square-cut seal 4 onto each cover 2.
  4. Lubricate o-ring inside of main filter 6 and install onto main filter cover 2.
  5. Align holes in filter cover 2 with holes in control module.
- MD/B 300/B 400 Series transmission beginning with S/N 6510069120 and HD/B 500 beginning with S/N 6610009730
  1. Remove twelve bolts 1, two filter covers 2, two gaskets 3, two o-rings 5, two o-rings 4, and two filters 6 from the bottom of the control module.
  2. Lubricate and install new o-rings 4 and 5 onto each cover 2.
  3. Lubricate o-ring inside of main filter 6 and push a filter onto each cover 2.
  4. Install new gasket 3 on each cover 2 and align holes in gasket with holes in cover.

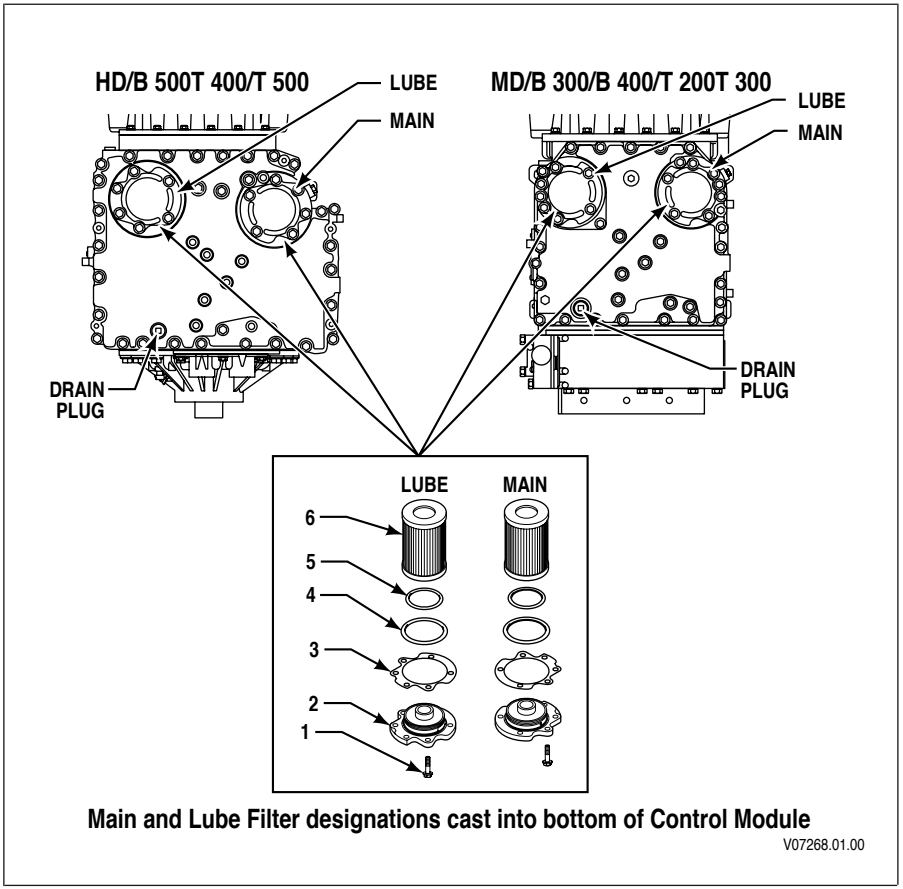


Figure 2–3. Location of Filters for Service

CAUTION: Do not use the bolts to draw the filter covers to the control module. Do not use an impact wrench to tighten the bolts. Using an impact wrench to tighten the bolts can strip threads and cause expensive parts replacement. Use a torque wrench to tighten the bolts.

For all transmissions:

1. Install filter and cover assemblies into filter compartment.
2. Align each filter/cover assembly with the holes in the channel plate/sump and push the cover assembly in by hand to seat the seals.
3. Install six bolts into each cover and tighten to 51–61 N•m (38–45 lb ft).

4. Replace control module drain plug O-ring and transfer case drain plug, if equipped.
5. Install the plug(s) and tighten to 25–32 N•m (18–24 lb ft).

c. Refill Transmission. Fluid remains in the torque converter, external circuits, and transmission cavities after draining the transmission. There, the amount of refill fluid will be less than the amount used for the initial fill. Refer to Figure 2–4, Sump Identification, for sump identification and Table 2–10, Transmission Fluid Capacity, for fluid fill quantities.

Check the fluid level using the procedures in Section 2–3, Transmission Fluid Check, Paragraph a. Electronic Fluid Check Procedure through Paragraph d. Hot Check Procedure, after filling the transmission.

Table 2–10. Transmission Fluid Capacity

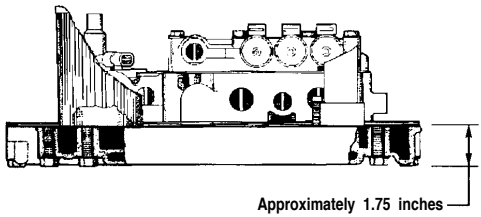
		Refill*	
Transmission	**Sump****	**Liters**	**Quarts**
MD/B 300/B 400	4 inch	18	19
MD/B 300/B 400	2 inch	11	12
HD/B 500	4 inch	37	39
HD/B 500/4000MH	2 inch	30	31

* Approximate quantity, does not include external lines and cooler hoses.

** Refer to Figure 2–4 for sump identification.

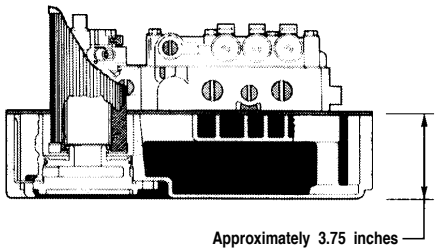
2 INCH SUMP

Requires filter approximately 102 mm (4 inch) in length.



4 INCH SUMP

Requires filter approximately 152 mm (6 inch) in length.



7 INCH—3070PT SUMP

Requires filter approximately 102 mm (4 inch) in length.

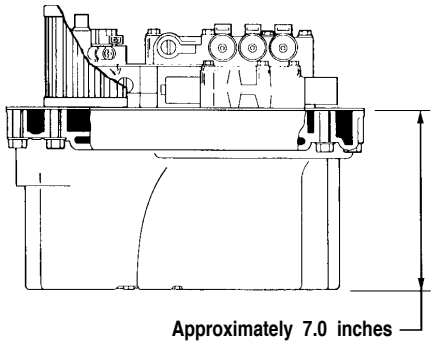


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Figure 2–4. Sump Identification

2–9. FLUID LEAK DIAGNOSIS

a. Finding the Leak.

1. Identify the fluid, determining whether it is:
   - Engine fluid
   - Automatic transmission fluid
   - Hydraulic fluid from a specific vehicle system.
2. Operate the vehicle to reach normal operating temperature and park the vehicle. Refer to the following list for possible points of fluid leaks and their causes:
   - Transmission mating surfaces:
     — Attaching bolts not correctly aligned
     — Improperly installed or damaged gasket
     — Mounting face damaged
   - Housing leak:
     — Fill pipe or plug seal damaged or missing
     — Filler pipe bracket dislocated
     — Oil cooler connector fittings loose or damaged
     — Output shaft seals worn-out or damaged
     — Pressure port plugs loose
     — Porous casting.
   - Leak at converter end:
     — Converter seal damaged
     — Seal lip cut (check converter hub for damage)
     — Garter spring missing from seal
     — Converter leak in weld area or o-ring seal
     — Porous casting.
   - Fluid comes out of fill tube:
     — Overfilled
     — Incorrect dipstick
     — Plugged vent
     — Water or coolant in fluid (fluid appears milky)
     — Incorrect electronic fluid indication
     — Drain-back holes plugged.

3. Visually inspect the suspected leaking areas, including all gasket mating surfaces.
4. If the source of the leak cannot be identified, clean with steam or spray solvent and dry the suspected areas.
5. Operate the vehicle for several miles at varying speeds. Inspect the vehicle again for leaks.
6. If the leak source still cannot be identified, refer to Paragraph b. Powder Method, and/or Paragraph c. Black light and Dye Method, to find the leaks.

b. Powder Method.

- Clean the suspected area.
- Apply an aerosol-type white powder to the suspected area.
- Operate the vehicle under normal operating conditions.
- Visually inspect the suspected area and trace the leak path over the white powder.

c. Black light and Dye Method. A dye and black light kit for finding leaks is available. Refer to the manufacturer's directions when using the kit. Refer to the kit directions for the color of the fluid/dye mix.

- Pour the specified amount of dye into the transmission fill tube.
- Operate the vehicle under normal operating conditions.
- Direct the black light toward the area suspected of leaking. Dyed fluid will appear as a brightly colored path leading to the leak.

d. Repairing the Leak. Once the leak has been traced back to its source, inspect the leaking part for the following conditions, and repair as indicated:

- Gaskets:
  - — Fluid level/pressure is too high
  - — Plugged vent or drain-back holes
  - — Improperly tightened fasteners or damaged threads
  - — Warped flanges or sealing surfaces
  - — Scratches, burrs, or other damage to sealing surfaces
  - — Damaged or worn-out gasket
  - — Cracked or porous casting
  - — Improper sealant used, where applicable.

- Seals:
  - — Fluid level/pressure is too high
  - — Plugged vent or drain-back hole
  - — Damaged seal bore
  - — Damaged or worn-out seal
  - — Improper installation
  - — Cracks in component
  - — Output shaft surface scratched, nicked, or damaged
  - — Loose or worn-out bearing causing excess seal wear.
- Sealing Flange:
  - — Inspect the sealing flange for bends; replace the sealing flange if bent

2–10. BREATHER

a. Location and Purpose. The breather is located on top of the transmission converter housing. The breather prevents air pressure buildup within the transmission and its passage must be kept clean and open.

b. Maintenance.

CAUTION: Do not spray steam, water, or cleaning solution directly at the vent assembly (breather). Spraying steam, water, or cleaning solution at the vent assembly can force the water or cleaning solution into the transmission and contaminate the transmission fluid. Seal all openings and the vent assembly (breather) before spraying steam, water, or cleaning solutions on the transmission.

Use care when cleaning the transmission. The amount of dust and dirt encountered will determine the frequency of breather cleaning.

c. Replacement. Always use a correctly sized wrench to remove or replace the breather. Using pliers or a pipe wrench can crush or damage the breather stem and produce metal particles which could enter the transmission. Tighten the breather to 12–16 N•m (9–12 lb ft).

2–11. TROUBLESHOOTING

a. DO NOT SHIFT Light (Figure 2–5, Shift Selectors). The **DO NOT SHIFT** light is usually located on the vehicle's instrument panel.

Lever shift selector — When the light is ON and accompanied by an alarm of eight seconds of short beeps, shifts are inhibited by the ECU.

Pushbutton shift selector — When the light is on, shifts are inhibited by the ECU. The Select digit on the shift selector is blank and no alarm warning sounds.

- This occurs when the ECU senses abnormal conditions in the transmission.
- The transmission may continue to operate with inhibited shifting.
- The ECU **will not** respond to the shift selector requests.
- Direction changes and shifts to and from **N** (Neutral) will not occur.
- If the lever shift selector is moved while **DO NOT SHIFT** is indicated, a continuous alarm sounds. This alarm continues until the shifter is moved back to the position it was in when the light came on initially.
- The pushbutton shift selector does not have an alarm if another range is selected when **DO NOT SHIFT** is indicated.
- If the ignition is turned OFF and then ON while **DO NOT SHIFT** is displayed, the transmission will remain in **N** (Neutral) until the diagnostic code is cleared.

Anytime the **DO NOT SHIFT** light is displayed, the ECU logs a diagnostic code in memory. These diagnostic codes can be accessed through Allison DOC™ service tool or the shifter selector.

NOTE: Diagnostic codes can be logged without illuminating the **DO NOT SHIFT** light. This occurs when the ECU senses a problem, but determines the problem will not cause immediate transmission damage or dangerous performance.

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b. Diagnostic Codes Overview.

Table 2–11. Diagnostic Codes Overview

Displayed on shift selector				Accessible by Allison DOC™ service tool only	
Code List Position	Main Code	Subcode	Active Indicator *	Ignition Cycle Counter	Event Number
d1	21	12	YES	00	10
d2	41	12	YES	00	04
d3	23	12	NO	08	00
d4	34	12	NO	13	01
d5	56	11	NO	22	02
* YES=MODE ON displayed					

Diagnostic codes are listed in memory. Up to five codes can be stored, with the most recent code stored listed first.

Diagnostic codes consist of a two-digit main code and a two-digit sub code (Table 2–11, Diagnostic Codes Overview).

- Main codes are listed first and provide the general condition or area of a fault detected by the ECU.
- Sub codes are listed second and provide specific areas or conditions within the main code that caused the occurrence.
- Example Code 13 12:
  - — 13 indicates a problem with ECU voltage
  - — 12 indicates the problem is caused by low voltage.
- Example Code 21 12:
  - — 21 indicates a problem with the throttle position sensor signal
  - — 12 indicates the throttle position sensor signal is low

The displayed code is currently active if the MODE ON indicator in the display window (Figure 2–5, Shift Selectors) is illuminated. The displayed code is inactive if the MODE ON indicator is not illuminated. In normal operating mode, an illuminated MODE ON display indicates secondary mode operation.

- The Ignition Cycle Counter determines when inactive diagnostic codes are automatically cleared from the code list. The counter is advanced each time a normal ECU powerdown occurs (ignition turned off). Inactive codes are cleared from the code list after the counter reaches 25.

- The Event Counter counts the number of occurrences of a diagnostic code. If a code is already in the code list and the code is again detected:
  - — The code is moved to position d1
  - — The active indicator is turned on
  - — The Ignition Cycle Counter is cleared
  - — The event counter is advanced one position.
- The ignition cycle counter and event calendar information may be accessed by using Allison DOC™ For PC diagnostic tool. Refer to Allison DOC™ for PC, GN3433EN, for specific instructions.

c. Clearing Trouble Codes Using Shift Selector. During installation, "false" codes can be recorded in the electronic control memory. Clear these codes before road testing the vehicle. Use the shift selector to clear the codes (Figure 2–5, Shift Selectors:

- Pushbutton shift selectors — enter the diagnostic mode by simultaneously pressing the ↑ **(Up)** and ↓ **(Down)** arrow buttons. Simultaneously press the ↑ **(Up)** and ↓ **(Down)** arrow buttons twice if an oil level sensor is present.
- Lever selectors — enter the diagnostic mode by momentarily pressing the **Display Mode** button. Press the **Display Mode** button twice if an oil level sensor is present.
- To clear all active indicators, press and hold the **MODE** button approximately 3 seconds until a tone sounds once.
- To remove all codes, press and hold the **MODE** button for approximately 10 seconds until the shift selector tone sounds twice.

d. Retrieving Troubleshooting Codes. During installation, "false" codes can be recorded in the electronic control memory. Clear these codes before road testing the vehicle. After road testing the vehicle, check for the codes. Retrieve the codes by using the shift selector (Figure 2–5, Shift Selectors).

1. Enter diagnostic mode (Paragraph c. Clearing Trouble Codes Using Shift Selector).
2. The display window will list the code logged position (d1, d2, d3, etc.), then follow with the main code and a sub code. This display sequence repeats every two seconds until the **MODE** button is pressed again).
3. Momentarily press the **MODE** button to move to the next code stored in memory.
4. When all codes have been retrieved, the display will return to the first code listed and repeat the sequence. **RECORD ALL CODES**.

NOTE: Use Allison DOC™ service tool to clear and retrieve the troubleshooting codes. Refer to Allison Transmission publication number GN3433EN, User's Guide, for specific instructions.

e. Troubleshooting When No Diagnostic Codes Are Present.

- Always start with the basics:
  - — Make sure the shifter is in the appropriate range.
  - — Check fluid level.
  - — Make sure batteries are properly connected and charged.
  - — Make sure electrical connections are properly made.
  - — Check support equipment for proper installation and operation.
- If the shifting process is rough, give the shifts time to "converge" before assuming there is a problem.

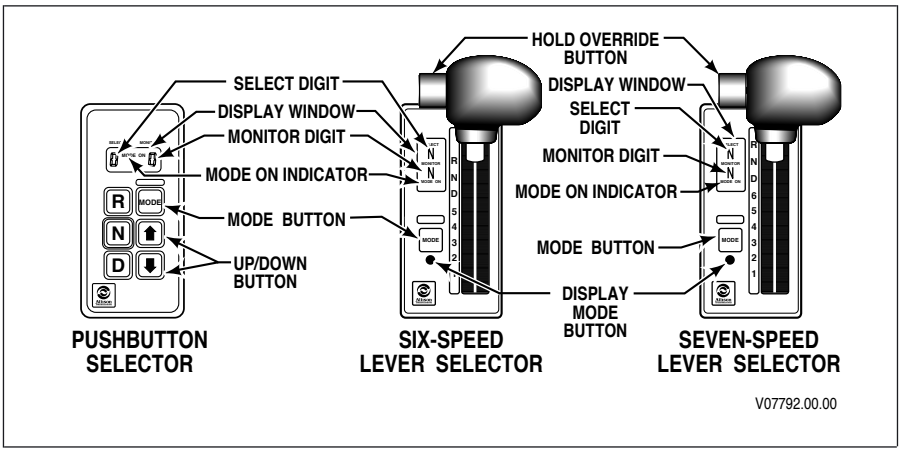

Figure 2–5. Shift Selectors

- Refer to Allison Transmission publication number TS2470EN, MD/HD/B Series WTEC II Electronic Controls Troubleshooting Manual, under the "General Troubleshooting of Performance Complaints" section.
  - — These troubleshooting charts list a variety of conditions that may or may not relate to the electronic control.
  - — Some conditions and suggested checks include mechanical and hydraulic items.
- Use the diagnostic code troubleshooting information that best applies to the situation if the troubleshooting charts refer to an electronic control check.
- Use the MD/HD Product Line individual clutch-apply circuit pressure taps when necessary (Figure 2–6, Clutch Pressure Check Points).

f. Troubleshooting Intermittent Diagnostic Codes. Intermittent codes are a result of conditions which are not always present. When conditions causing the code exist, the code is logged in memory. The code stays in memory until it is manually cleared or cycled out.

When intermittently occurring codes exist, check for the following items:

- Dirty, damaged, or corroded harness connectors and terminals.
- Terminals not fully seated in connectors.
- Damaged harnesses due to poor routing, chafing, excessive heat, tight bends, etc.
- Improperly mounted electronic control components.
- Poor connector seals (where applicable).
- Exposed harness wires.
- Electromagnetic interference (EMI) generating components and accessories.
- Loose, dirty, or corroded ground connections.

To help locate intermittents, it sometimes helps to place the appropriate tester on the suspected component or circuit and simulate operating conditions — wiggle, pull, bump, and bend while watching the tester.

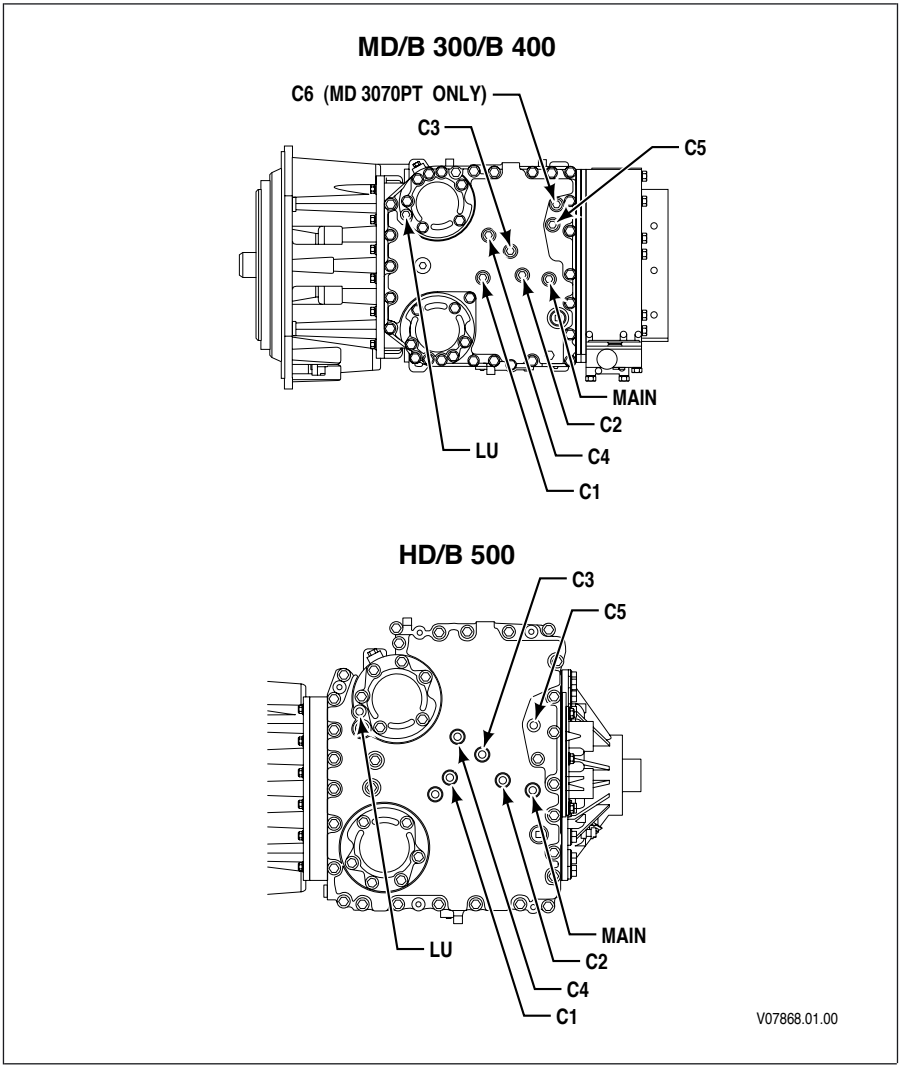

Figure 2–6. Clutch Pressure Check Points

g. Exiting Diagnostic Mode. To exit the diagnostic mode, do one of the following (Figure 2–5, Shift Selectors):

- Do nothing; wait until the calibrated time has passed and the system automatically returns to normal operation.
- A pushbutton shift selector requires one of the following actions:
  - — Simultaneously press the ↑ **(Up)** and ↓ **(Down)** arrow buttons
  - — Press **N** (Neutral), **D** (Drive), or **R** (Reverse).

- A lever shift selector requires one of the following actions:
  - — Press the **DISPLAY MODE** button once.
  - — Move the selector lever to any position other than the one it was in when the diagnostic display mode was activated.

2–12. TRANSMISSION STALL TEST AND NEUTRAL COOL-DOWN CHECK

a. Purpose. A stall test is used to determine if unsatisfactory performance is caused by the engine or transmission.

A neutral cool-down check is a two minute cooling period after a stall test to gather fluid temperature data for troubleshooting.

The engine stall rpm under load is compared to the engine manufacturer's specified rpm for the stall test.

NOTE: The engine manufacturer's test data MUST BE available for the stall test. This data can be obtained from the engine manufacturer or equipment dealer or distributor.

NOTE: Allison DOC™ service tool may be used to perform a stall test or clutch test procedure. Refer to Allison Transmission publication number GN3433EN, Allison DOC™ for PC, for specific instructions.

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b. Stall Test (Non-Smoke Controlled Engines). Perform the following procedures:

1. Connect a tachometer (Allison DOC™ service tool can read engine rpm) of known accuracy to the engine and install a temperature probe into the converter-out (to cooler) hose.
2. Bring the engine to the normal operating temperature.

WARNING: Avoid injury and/or property damage caused by unexpected vehicle movement by not starting a stationary stall test until you have taken all of the following actions:

- Put the transmission in **P** (Park) or **PB** (Auto-Apply Parking Brake), if available, or **N** (Neutral).
- Apply the parking brake and service brake.
- Chock the vehicle wheels and take any other steps necessary to keep the vehicle from moving.
- Warn personnel to keep clear of the vehicle and its path.

CAUTION: DO NOT conduct a stall test in **REVERSE**. The torque produced in **REVERSE** can damage the vehicle driveline or axle.

3. Shift to any forward range. Fourth-range is recommended. Attain fourth-range by using the Allison DOC™ service tool.

CAUTION: The stall condition causes a rapid rise in fluid temperature; never maintain the stall for more than 30 seconds at any one time. Do not let the converter-out fluid temperature exceed 149°C (300°F). During stall conditions, converter-out temperature rises much faster than internal temperatures. Do not use internal fluid temperature to determine the length of the stall condition. If the stall test is repeated, do not let the engine overheat.

4. With the vehicle wheels blocked, parking and service brakes applied, hold the engine at wide-open throttle.
5. Reduce engine rpm to idle and shift to **N** (Neutral).
6. Monitor converter-out temperature.
7. Proceed immediately to the procedures in Paragraph d. Neutral Cool-Down Check Procedure in this Section.

c. Stall Test (Smoke Controlled Engines). Perform the following procedures:

NOTE: The stall test may have to be performed while the vehicle is moving because smoke controls and throttle-delay mechanisms inhibit engine acceleration.

1. Locate an isolated area in which to perform the driving stall test.
2. Select a hold range that will limit road speed. Second- or third-range are best, but not low-range because it produces very high torque.
3. Operate the engine at full throttle, maximum governed speed.
4. Gradually apply the vehicle service brakes while staying at full throttle.
5. Record the engine speed (rpm) when the vehicle comes to a complete stop. This is the engine stall speed for the engine-transmission combination.
6. Proceed immediately to the procedure in Paragraph d. Neutral Cool-Down Check Procedure.

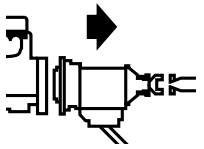
d. Neutral Cool-Down Check Procedure. The neutral cool-down check determines if the transmission fluid cools following an engine load condition. Perform the following procedures immediately after the maximum engine rpm has been recorded in the stall test:

1. Record the converter-out fluid temperature.
2. Reduce the engine rpm to idle and shift to **N** (Neutral).
3. Run the engine at 1200–1500 rpm for two minutes to cool the fluid.
4. Record the converter-out fluid temperature at the end of the two-minutes. Converter-out fluid temperature should return to within normal operating temperature range.
5. If the fluid does not cool during the two minute cool-down check, a stuck stator may be the source of the problem.

e. Stall Test Results.

NOTE: Environmental conditions, such as ambient temperature, altitude, engine accessory loss variations, etc., affect the power input to the converter. Under such conditions, stall speed can vary from specification by ±150 rpm and still be accepted as within normal range.

- An engine problem is indicated if engine stall speed is more than 150 rpm below engine manufacturer's specification.
- If engine stall speed is more than 150 rpm above engine manufacturer's specification, a transmission problem is indicated, such as:
  - — Slipping clutches
  - — Fluid cavitations
  - — Aeration
  - — Torque converter.
- An extremely low stall speed (such as 33 percent of the specified engine stall rpm), during which the engine does not smoke, could indicate a freewheeling stator in the converter.
- Perform a neutral cool-down check if engine stall-speed tests meet specifications, but causes the transmission fluid to overheat.
- An electronic control problem may exist if engine stall speed meets the specification and the cool-down check shows that transmission fluid cools properly. Refer to Allison Transmission publication number TS2470EN, MD/HD/B Series WTEC II Electronic Controls Troubleshooting Manual.

Section III	REMOVING TRANSMISSION	

3–1. DRAINING TRANSMISSION

Drain the transmission fluid before removing the transmission from the vehicle.

- Remove the drain plug from the oil pan. Examine the drained fluid for evidence of contamination (refer to Section 2–7, Transmission Fluid Contamination, Paragraph a. Monitoring Contaminant Levels through Paragraph c. Water/Engine Coolant Contaminant). Install the drain plug.
- Remove the transmission fill tube if it interferes with transmission removal. Plug the fill tube hole in the main housing to keep dirt from entering the transmission.

NOTE: A significant amount of fluid may drain from the hydraulic lines when they are disconnected from the transmission.

- Disconnect all hydraulic lines from the transmission. Remove the lines from the vehicle if they interfere with transmission removal. Plug all openings to keep dirt from entering the hydraulic system.
- If an integral cooler is used, drain coolant from cooler and disconnect coolant hoses. Remove the hoses from the vehicle if they interfere with transmission removal. Plug all openings to keep dirt from entering the cooling system.

3–2. DISCONNECTING CONTROLS

- Disconnect or completely remove controls. If controls are not removed from the transmission, position them so that they do not interfere with transmission removal.
- Disconnect the external wiring harness at the feedthrough harness connector. Refer to Figure 3–1 or Figure 3–2. Disconnect the external wiring harness at the transmission connect (Figure 3–3) on earlier models. Prevent dirt or moisture from entering a disconnected connector. Position the wiring harness so it does not interfere with transmission removal.

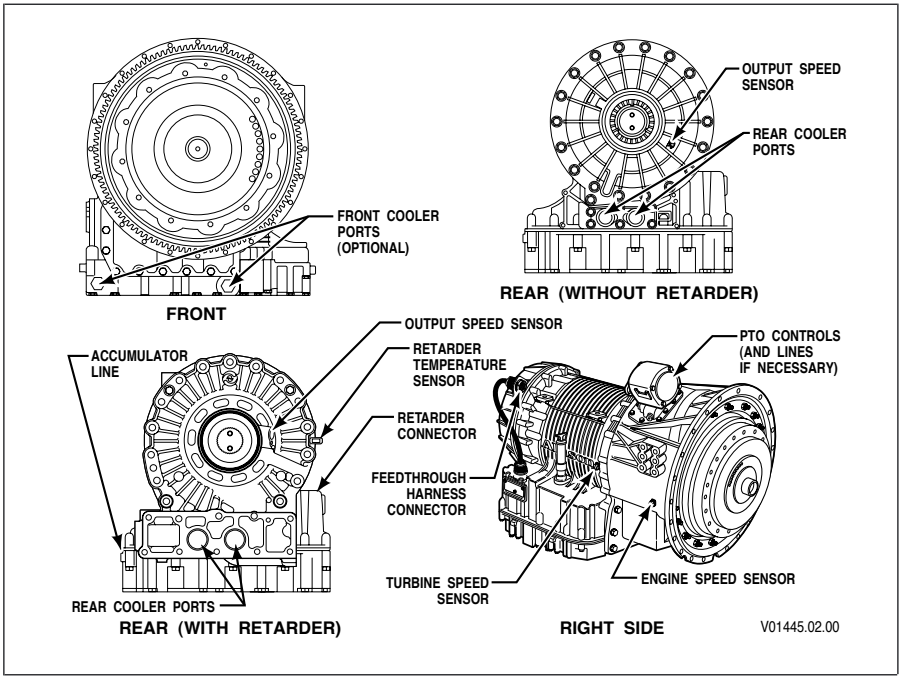


Figure 3–1. HD/B 500 Disconnect Locations

- For the MD/B 300/B 400, disconnect the engine and output speed sensors (Figure 3–2 and Figure 3–3).
- For the HD/B 500, disconnect the engine, turbine, and output speed sensors (refer to Figure 3–1).

NOTE: There may be residual transmission fluid in the retarder-accumulator hydraulic line.

- If a retarder is used, disconnect the retarder accumulator hydraulic line from the retarder.
  - — For MD/B 300/B 400, disconnect the transmission external harness from the retarder connector (Figure 3–2 and Figure 3–3).
  - — For the HD/B 500, disconnect the retarder connector and the retarder temperature sensor connector (Figure 3–1).
- If a PTO(s) is used, disconnect the PTO(s) wiring harness.

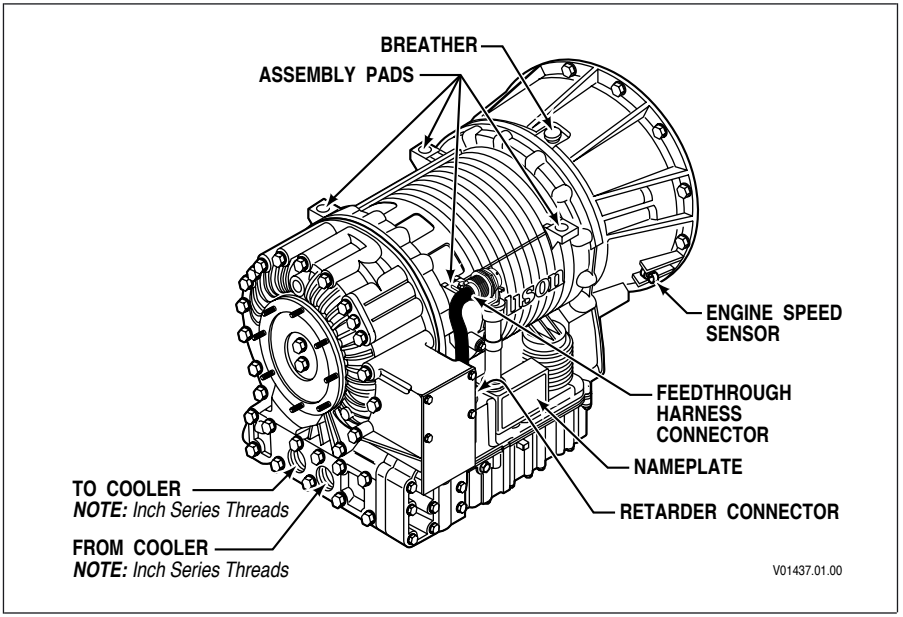


Figure 3–2. MDR/B 300/B 400 Disconnect Locations

3–3. UNCOUPLING FROM DRIVELINE, ENGINE, AND VEHICLE

- Disconnect the vehicle drive shaft from the transmission output flanges or yokes. Position the disconnected shaft to avoid interference when removing the transmission.
- If PTO equipped, disconnect PTO connections such as:
  - — PTO hydraulic hoses
  - — PTO-powered equipment drive shaft
- Place a jack or other support under the engine if transmission mountings support the rear of the engine.
- Securely support the transmission with a hoist, jack, or other suitable removal equipment.
- Remove all bolts, nuts, washers, spacers, and supports that attach the transmission to the vehicle and the engine.

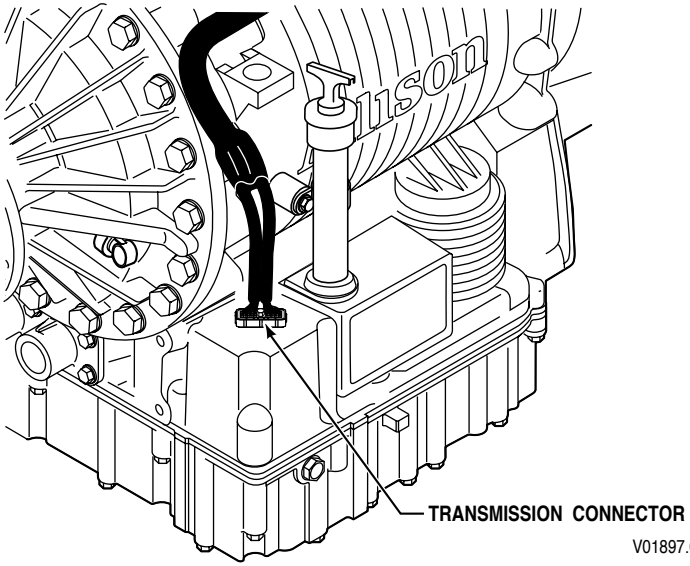


Figure 3–3. MD/B 300/B 400 Transmission Connector Before S/N 6510032369

3–4. REMOVING THE TRANSMISSION

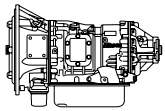
- Move the transmission away from the engine, approximately 110 mm (4.35 inches), until it is completely clear of the engine. If used, remove the adapter ring and/or gasket.
- Raise or lower the transmission as necessary to remove it from the vehicle.

3–5. REMOVING OUTPUT FLANGES OR YOKES

Output flanges or yokes may need to be transferred to the replacement transmission.

- The MD Series transmission output flanges or yokes are attached by two M10 x 1.5 bolts tightened to 30–35 mm (22–26 lb ft) and includes a locktab.
- HD Series transmission output flanges or yokes are attached by two M10 x 1.5 bolts tightened to 51–61 mm (38–45 lb ft) and includes a locktab.
- Remove dirt and burrs from the shaft threads.
- Loosen the nut until there is about $^{1}/_{16}$ inch gap between the nut and flange.

- Check the running torque as the nut is being removed. The running torque **must be** at least 19.5 (14 lb ft). Discard the nut if it does not meet the running torque limit.



TRANSMISSION PREPARATION

Section IV

4–1. CHECKING INPUT COMPONENTS

a. Bolt Holes. Check all bolt holes on the front of the flywheel/converter cover/flexplate adaptor. The threads must be undamaged and the holes free of chips or foreign material.

b. Pilot Boss. Check the pilot boss (at the center of the flywheel) for damage or raised metal that prevents free entry into the crankshaft hub (or adapter).

c. Starter Ring Gear. Check the starter ring gear for excessive wear or damage.

d. Transmission Mounting Flange. Check the transmission mounting flange for raised metal, dirt, or if used, pieces of gasket material.

e. Transmission-to-Engine Mounting. Inspect the transmission-to-engine mounting flange for raised metal, burrs, or pieces of gasket material (if used). Remove any of these defects. Inspect the threaded holes for damaged threads

4–2. INSTALLING OUTPUT FLANGE OR YOKE

a. Output Oil Seal. Check the output oil seal for leaks or damage. Refer to Section 8–2, Service Literature, Table 8–1 for the appropriate service manual for replacement instructions. Lubricate the oil seal with high-temperature grease or transmission fluid if it is not being replaced.

CAUTION: DO NOT attempt to polish the oil seal contact surface on the flange or yoke. Scratches or machine-type lead can cause the seal to leak.

b. Check Flange or Yoke. Check each flange or yoke for damage or wear. The oil seal contact surface must be smooth and regular to prevent oil leaking past the seal. Rotate the flange after installation to check for binding.

c. Install Output Flange or Yoke.

- MD/B 300/B 400 Series, before S/N 6510184819 and HD/B 500 Series before S/N 6610038064.
  - — Install flange or yoke onto output shaft. Install the large O-ring on the retainer plug. Install a belleville washer on each bolt so that the coned end of the washer contacts the underside of the bolt head. Insert two bolt/washer assemblies into the bolt holes in the plug. Install a small O-ring over the threads of each bolt, so that the O-ring seats against the retainer plug. Install retainer plug and bolts into the flange or yoke.
  - — Tighten bolts to 30–35 N•m (22–26 lb ft) for an MD/B 300/B 400/ 3000MH Series transmission.
  - — Tighten bolts to 51–61 N•m (38–45 lb ft) for an HD/B 500/4000MH Series transmission.
  - — Rotate the flange or yoke to check for binding.
- MD/B 300/B 400 Series, beginning with S/N 6510184819 and HD/B 500 Series beginning with S/N 6610038064 and all MH Series.
  - — Install flange or yoke onto output shaft. Install the large O-ring on the retainer plug. Insert one bolt into the bolt hole in the plug. Install a small O-ring over the threads of the bolt so that the O-ring seats against the retainer plug. Install retainer plug and bolt into the flange or yoke.
  - — Tighten bolt to 70–80 N•m (52–59 lb ft).

4–3. INSTALLING PTO

Access to the PTO mounting pads and the space available to maneuver the transmission determines whether the PTO should be installed before or after the transmission is installed.

CAUTION: DO NOT use cork or other soft gaskets to install the PTO. Use only the shims/gaskets listed in the MD/HD Product Line Parts Catalogs.

Refer to Section 8–2, Service Literature, Table 8–1 for the current parts catalog publication numbers for the MD/HD Product Line.

NOTE: DO NOT use sealing compounds. They are usually incompatible with automatic transmission fluid.

a. Install Gasket. Install the special gasket over the guide pins, ribbed surface away from the transmission.

b. Mount the PTO.

1. Mount the PTO on the guide pins, meshing the PTO driven gear with the transmission PTO drive gear.
2. Attach the PTO by installing a bolt in the top bolt hole.
3. Install the remaining bolts.
4. Tighten all bolts to 51–61 N•m (38–45 lb ft).

c. Install Guide Pins. The guide pins are included in the PTO manufacturers installation kit.

1. Determine the required position of the guide pins in relation to the mounted position of the PTO. The guide pins **must align** with the two blind holes in the PTO pad.
2. Install two headless guide pins into the converter-housing PTO pad.
3. Tighten the pins.

4–4. INSTALLING FILL TUBE AND SEAL

a. Location.

- HD/B 500 — fill tube is on the right side.
- MD/B 300/B 400 — fill tube may be mounted on either the right or left side. The unused fill tube provision **must have** an expansion plug to fill the tube opening.

b. Installation.

CAUTION: Install the fill tube brackets using the correct length bolts. A bolt that is too long can cause cracks and leaks in the main housing.

1. Install the fill tube seal into the main housing.
2. Insert the fill tube through the seal.
3. Align the tube bracket with its bolt location.
4. Install the fill tube bolt and tighten to 24–29 N•m (18–21 lb ft).

Refer to Section 8–2, Service Literature, Table 8–1, for the current parts catalog publication number for the MD/HD Product Line.

On all MD/B 300/B 400 Series transmissions, install the expansion plug in the unused fill tube hole. Tighten the plug to 1–3 N•m (9–26 lb ft).

4–5. CHECKING PLUGS AND OPENINGS

Carefully check all sides and bottom of transmission for loose or missing plugs.

a. Pressure Plugs. Check that the 0.4375–20 UNF-2A pressure plugs are tightened to 10–13 N•m (7–10 lb ft).

b. Fluid Drain Plug. Check that the drain plug is tightened to 25–32 N•m (18–24 lb ft).

c. Cleanliness. Check the openings into which the cooler lines connect for deformities or obstructions. Check the transmission electrical connectors for cleanliness. Clean electrical connectors with LPS Electro Contact Cleaner® cleaner only.

4–6. OUTPUT RETARDER ACCUMULATOR INSTALLATION REQUIREMENTS

The output retarder accumulator option **must be installed** as follows (Figure 4–1):

- Accumulator centerline no higher than top of main housing
- Accumulator horizontal to frame or cross member
- Maximum hydraulic hose length from transmission to accumulator of 1.8 m (6 ft)
- Maximum air supply hose length of 12 m (39 ft)
- Pressure protection valve of 586 kPa (85 psig) maximum closing pressure installed in air supply hose.

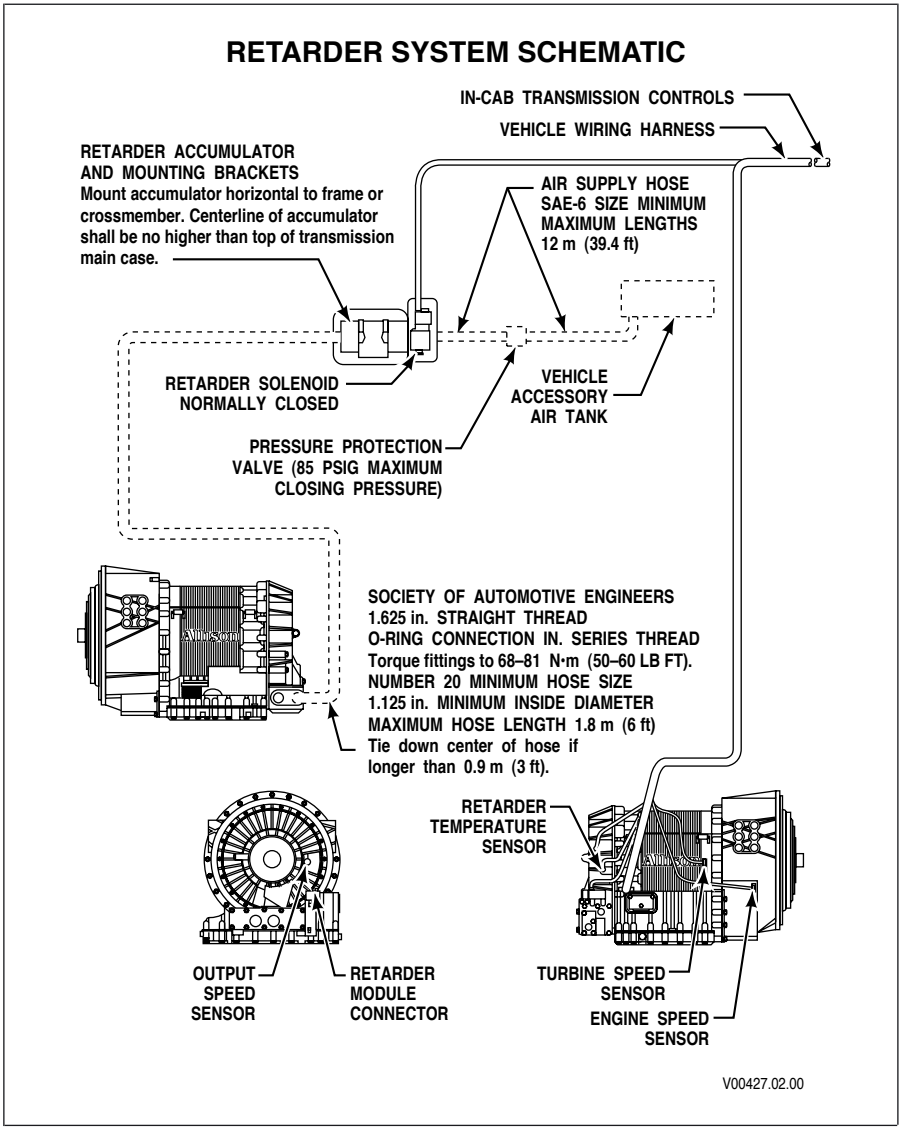


Figure 4–1. Output Retarder Accumulator Installation

Section V	PREPARING VEHICLE FOR TRANSMISSION INSTALLATION	

5–1. ENGINE, TRANSMISSION ADAPTATION REQUIREMENTS

You **must be sure** a new transmission installation can be adapted to the vehicle's engine. The measurements listed in this section describe the correct engine-to-transmission adaptation. Refer to Figure 5–1 or Figure 5–2 and/or AS67–020.

a. Measuring Equipment. The following measuring equipment is required:

- 600 mm (24 inches) precision caliper
- 50–100 mm (2–4 inches) telescoping gauge
- 25–76 mm (1–3 inches) outside micrometer
- Dial indicator and mounting attachments — base, posts, and clamps
- 0–150 mm (0–6 inches) depth micrometer.

b. Flywheel Housing Pilot Bore Diameter. The flywheel housing pilot bore diameter **must** measure:

- MD/B 300/B 400:

  447.68–447.81 mm (17.625–17.630 inches)
- HD/B 500:

  511.18–511.30 mm (20.125–20.130 inches).

c. Flywheel Housing Bore Runout. Flywheel housing bore total indicated runout (TIR) **cannot exceed** 0.51 mm (0.020 inch).

d. Flywheel Housing Face Squareness. The flywheel housing face **cannot be** out-of-square more than 0.51 mm (0.020 inch) TIR.

e. Crankshaft Hub Pilot or Adapter Diameter. The crankshaft hub pilot or hub adapter pilot diameter **must** measure between 50.94–50.99 mm (2.006–2.008 inches).

f. Crankshaft Hub Pilot or Adapter Squareness. The crankshaft hub or hub adapter **cannot be** out-of-square more than 0.13 mm (0.005 inch) TIR.

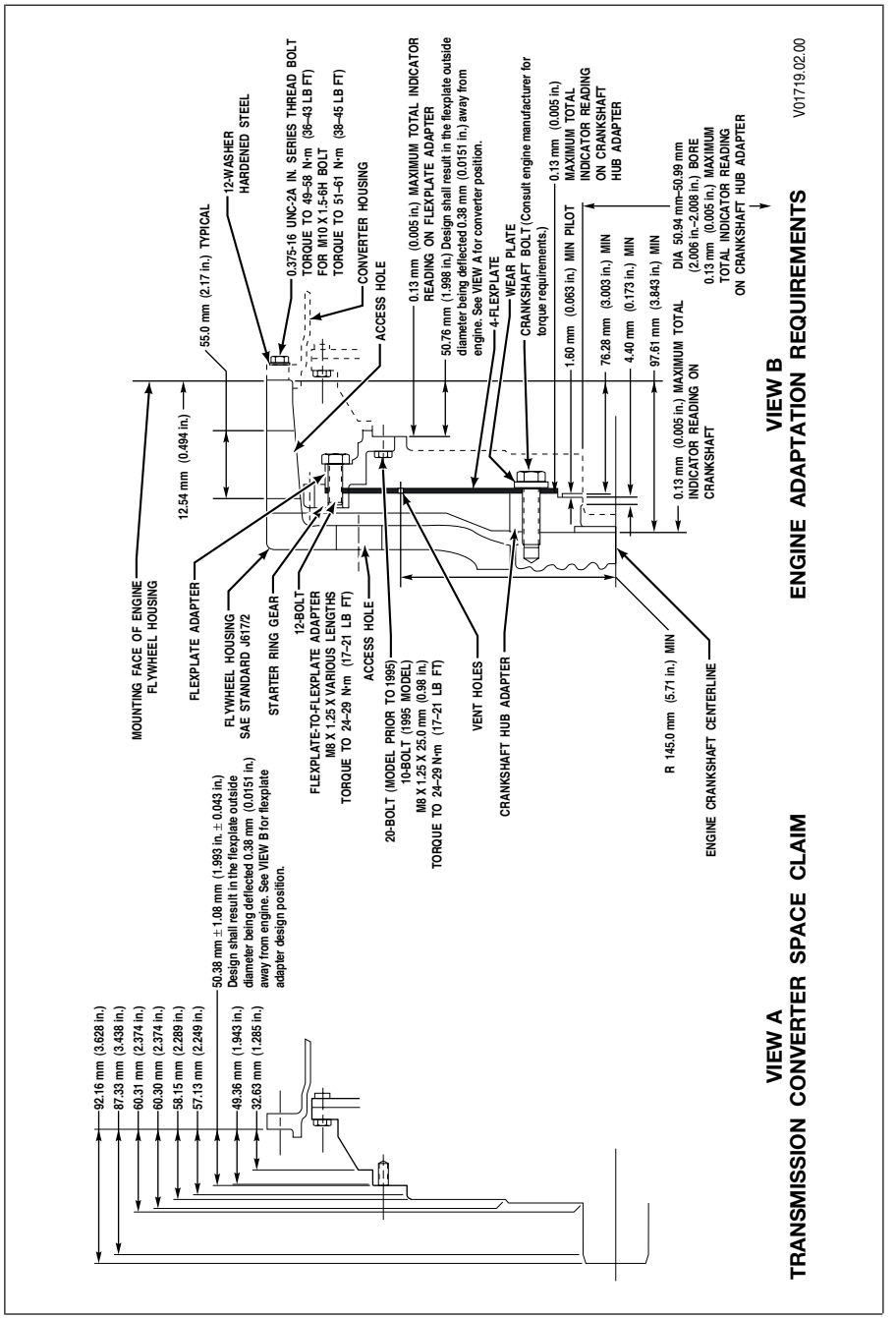
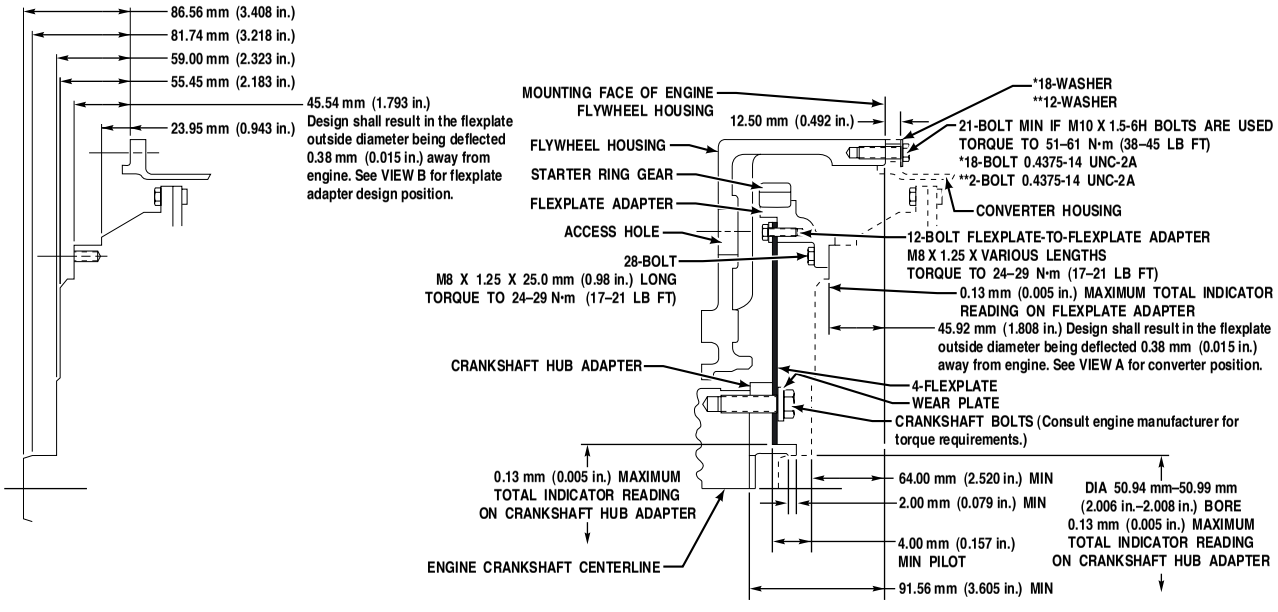


Figure 5–1. MD/B 300/B 400 Engine Adaptation



*Minimum if transmission side mounting pads are not used to mount powerpack.
**Minimum if transmission side mounting pads are used to mount powerpack.
Torque to 73—88 N¥m (54—65 LB FT).

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Figure 5–2. HD/B 500 Engine Adaptation

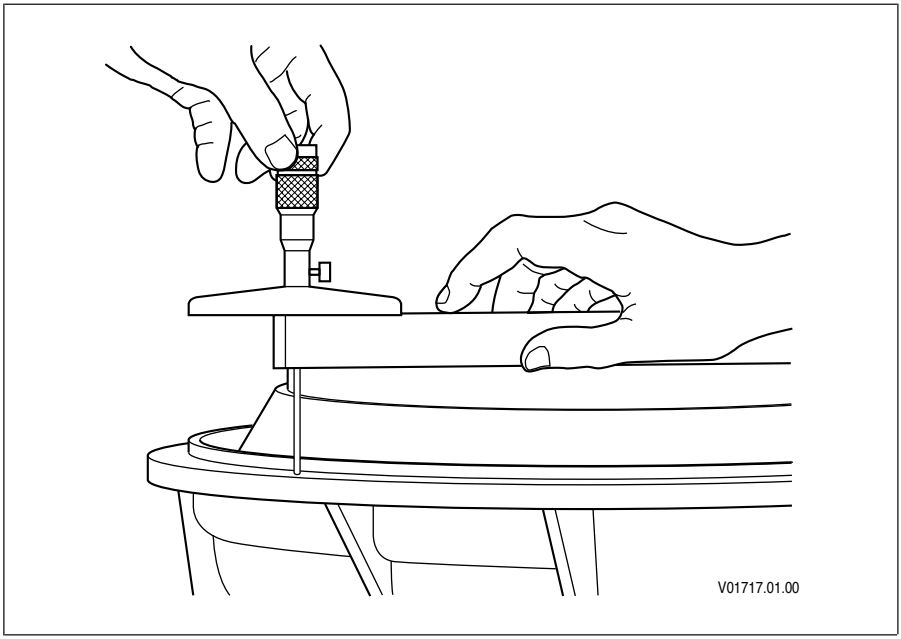


Figure 5–3. Converter Axial Location Measurement

g. Crankshaft Hub Pilot or Adapter Concentricity. The crankshaft hub pilot or the hub adapter pilot concentricity **cannot exceed** 0.13 mm (0.005 inch) TIR.

h. Flexplate Bolt Hole Flatness. Flexplate flatness in the area of the bolt holes is not a measurement required for the MD/HD Product Line.

i. Torque Converter Axial Location. Measure from the face of the torque converter housing to the torque converter flexplate adapter mounting face using a depth gauge (Refer to Figure 5–3). The torque converter axial location should measure:

- MD/B 300/B 400 Series transmission — 50.76 mm (2.0 inches).
- HD/B 500 Series transmission — 45.54 mm (1.80 inches).

5–2. CHECKING FLEXPLATE DRIVE ASSEMBLY

a. Flexplate Inspection. Check the flexplate for cracks, distortion, or elongated bolt holes. Replace a worn or damaged flexplate.

b. Engine Crankshaft End Play. Be sure engine crankshaft end play is within the engine manufacturer's specifications.

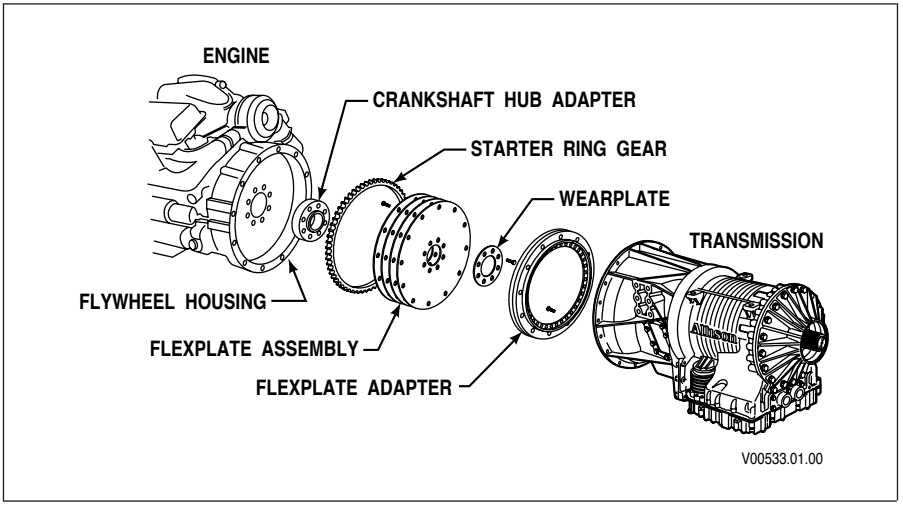


Figure 5–4. Arrangement of Adaptation Components

c. Flexplate Assembly Installation.

NOTE: Be sure the outer flexplate bolt holes are aligned when assembling the flexplate to the crankshaft hub or hub adapter.

Install the flexplate onto the engine crankshaft hub using the bolts and torque values specified for that engine. Refer to Figure 5–1, MD/B 300/B 400 Series transmissions or Figure 5–2, HD/B 500 Series transmissions, for engine adaptation requirements. Refer to Figure 5–4 for the proper position of the flexplate in relation to other adaptation components.

5–3. CHASSIS AND DRIVELINE INSPECTION

Inspect the chassis and driveline components for the following conditions, and correct them as appropriate:

- Transmission mounts — broken or worn-out
- Bolts and other hardware — damaged, missing, or incorrect
- Isolators (rubber mounts) — damaged or missing
- Driveline angles — runout, or balance which does not conform to the manufacturer's recommendations

- Driveline yoke slip joints:
  - — Freedom of movement
  - — Damaged or worn-out
  - — Correctly lubricated
  - — Correctly indexed
- Driveline midship or hanger bearings — damaged or misaligned
- Universal joints:
  - — Freedom of movement
  - — Damaged or worn-out
  - — Correctly lubricated
  - — Correctly indexed
- Vehicle differential backlash — manufacturer's specification
- Universal joint coupling — alignment and differential damage
- Cross-frame members and rear support members — condition and location
- PTO-driven equipment shafts and couplings — damaged or misaligned
- Auxiliary transmission:
  - — Shaft alignment
  - — Alignment of yoke or flange
  - — Backlash
  - — Fluid leaks.

5–4. COOLER, FILTER, AND LINES

a. Inspection. Perform the following and correct any faulty conditions:

- Transmission fluid cooler and related coolant lines:
  - — Check for contamination
  - — Clean and flush as necessary
  - — Inspect for deterioration
  - — Inspect for faulty connectors or kinks
  - — Clean and flush transmission fluid cooler, both coolant and oil sides, per manufacturer's specifications.

- Hydraulic lines:
  - — Check for contamination
  - — Clean and flush as necessary
  - — Inspect for deterioration
  - — Inspect for faulty connectors or kinks.

b. After Overhaul. A complete cleanup of the transmission system after an overhaul cannot be assumed. Repeated cleaning and flushing may not remove all debris from the transmission fluid cooler system. Replace the transmission "from cooler" oil filter after 8000 km (5000 miles). Refill the transmission to the correct fluid level (refer to Section 2–8, Transmission Fluid and Filter Change Procedure, Paragraph c. Refill Transmission).

5–5. CHECKING CONTROLS

a. Inspection. Inspect the following and correct any faulty conditions:

- Shift selector:
  - — Improper operation
  - — Poor electrical connections
  - — Improper harness routing.
- Cab and chassis wiring harness:
  - — Poor electrical connections
  - — Frayed insulation
  - — Wiring damage.
- Throttle sensor components:
  - — Freedom of movement
  - — Improper routing
  - — Bellows damage
  - — Improper or loose cable mounting.
- PTO controls:
  - — Damage
  - — Wear
  - — Improper operation
  - — Lubrication
  - — Electrical harness connections and wiring damage.

- Retarder Controls:
  - — Damage
  - — Wear
  - — Poor electrical harness connections
  - — Frayed insulation
  - — Wiring damage.
- Temperature gauge:
  - — Capillary tube damage (if used)
  - — Sensor damage
- Fluid pressure gauge tubing:
  - — Damage
  - — Kinks
  - — Improper routing

b. Throttle Position Sensor (TPS) Adjustment — Using Diagnostic Tool. The throttle position sensor (TPS) should not need adjustment if properly installed by the equipment manufacturer. If TPS adjustment is necessary, confirm that it has been installed to AT specification (Figure 5–5). The TPS is self-calibrating and therefore has no optimum closed throttle or full throttle count value. Idle count should be 50 or higher and full throttle count 200 or lower. The TPS is set correctly as long as the counts are in the 50 and 200 range with a difference of 85 to 130 counts between closed and full throttle.

The Allison DOC™ service tool can read TPS counts. Watch the TPS movements as the controls move it through a full stroke. Be sure the following conditions **do not** exist:

- Misalignment or obstruction to smooth movement through the full stroke
- Idle and full throttle positions are not within an error zone (Figure 5–6).

Error codes occur if the idle position is less than 14 counts or when the full throttle position is more than 233 counts.

c. Hitch-Pin Throttle Position Sensor Installation.

- Install the throttle sensor body as follows:
  1. Clamp cable end using clamp and shims (refer to Figure 5–5).
  2. Secure the sensor body using the mounting holes provided.
  3. Install a heat shield if any part of the throttle sensor is near the exhaust manifold, turbochargers, or any other heat source.

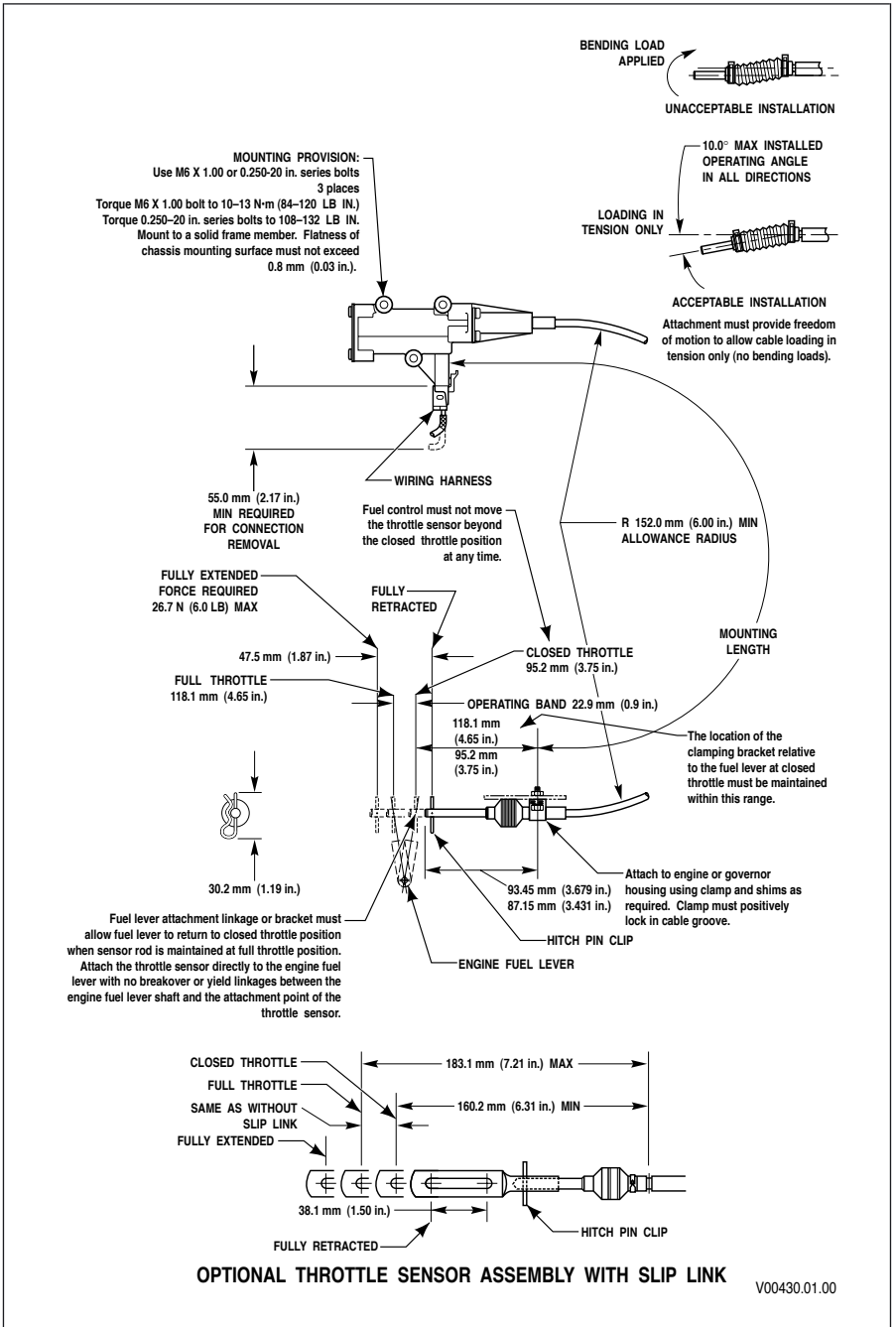


Figure 5–5. Hitch-Pin Throttle Position Sensor Installation Diagram

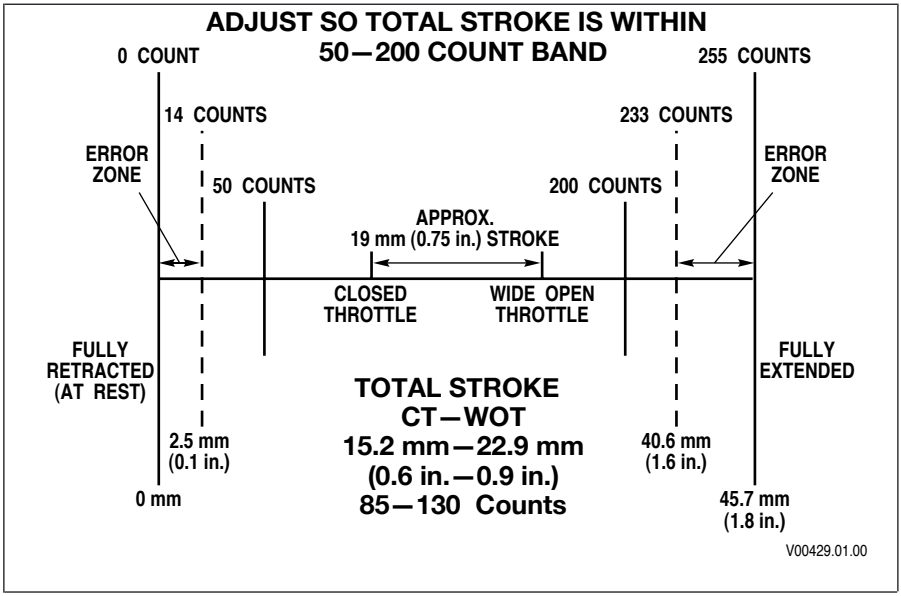
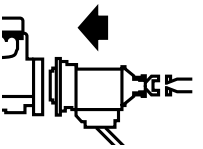


Figure 5–6. Throttle Position Determination Diagram

- Adjust the throttle sensor as follows:
  1. The engine fuel lever must be at the closed throttle position.
  2. Install the hitch pin cable end of the sensor to the engine fuel lever with brackets so that at the idle position the cable end is 11–17 mm (0.44–0.67 inch) from its fully retracted position, and at wide open throttle the cable end is pulled 15.2–22.9 mm (0.60–0.90 inch) from the idle position.
  3. Check the stroke distance of the throttle sensor, from closed to wide open. Stroke distance must be from 15–22.9 mm (0.60–0.90 inch).
  4. Recheck for zero clearance at the fuel lever. Make sure the 15.2–22.9 mm (0.60–0.90 inch) dimension has not changed.
  5. Design throttle sensor linkage brackets and levers to nominal dimensions so the system stays within tolerance bands throughout its operating life.

Section VI	INSTALLING TRANSMISSION INTO VEHICLE	

6–1. HANDLING

a. Preventing Damage. Carefully handle the transmission to prevent damage to components in the installation path.

b. Control of Transmission Movements. Use a hoist or transmission jack that allows precise control of transmission movements during installation.

6–2. MOUNTING TO ENGINE

Use the following procedure to mount the transmission to the engine:

1. Align one of the flexplate bolt holes with the access opening at the front of the engine flywheel housing.
2. Lubricate the center pilot boss with molybdenum disulfide grease (Molycote G, or equivalent).
3. Push the transmission toward the engine while guiding the pilot boss on the torque converter into the flexplate hub adapter and the guide bolt into the hole on the flexplate.
4. Seat the transmission squarely against the engine flywheel housing — no force is required. If interference is encountered, move the transmission away from the engine and investigate the cause.

CAUTION: The entire converter housing circumference must be flush against the engine flywheel housing before tightening any bolts. DO NOT use the bolts to seat the housing.

5. Align the bolt holes in the converter housing with those in the engine flywheel housing.
6. Install all transmission-to-engine bolts finger tight.
7. Tighten four bolts at 90 degree intervals around the converter housing bolt circle. Use the torque specified by the engine or vehicle manufacturer; usually M10 x 1.5-6H bolts tighten to 36–61 N•m (27–45 lb ft) or $^{7}/_{16}$-14 bolts tightened to 73–88 N•m (54–65 lb ft).

NOTE: DO NOT tighten any flexplate-to-flexplate adapter bolts until all of the bolts have been installed and tightened finger tight.

8. Rotate the engine crankshaft to install the remaining self-locking bolts into the flexplate adapter.
9. Install the flywheel housing access cover.

6–3. INSTALLING TRANSMISSION MOUNTING COMPONENTS

CAUTION: Use the type and grade of mounting bolts recommended by the vehicle manufacturer.

1. Install all bolts, washers, spacer, isolators, or supports required to support the transmission in the vehicle frame.
2. Tighten the bolts to the torque values recommended by the vehicle manufacturer.

6–4. COUPLING TO DRIVELINE

1. Couple the driveline companion flange or universal joint yoke to the flange or yoke on the transmission. Use the bolts and torque values recommended by the vehicle manufacturer.
2. Check the universal joint angularity of all U-joints in the driveline. Determine if they are within specification.

6–5. CONNECTING OUTPUT RETARDER ACCUMULATOR

The output retarder is connected to the vehicle air system by an air supply line attached to the retarder control solenoid mounted on the end of the retarder accumulator (Figure 4–1).

NOTE: Be sure a one-way check valve is correctly installed between the vehicle brake air system and the accumulator control solenoid.

1. Connect the air supply hose fitting to the retarder air control solenoid. Tighten the fitting to 16–22 N•m (12–16 lb ft).
2. Connect the hydraulic hose between the retarder and the accumulator. Tighten hose fittings to 68–81 N•m (50–60 lb ft).

6–6. CONNECTING POWER TAKEOFF CONTROLS

Mount the PTO(s) onto the transmission (refer to Section 4–3, Installing PTO).

1. Check the PTO harness routing for kinks and sharp bends. Avoid routing the cable close to exhaust pipes or manifold. The PTO harness must not rub or interfere with adjacent parts.
2. Connect controls to the PTO.
3. Check for proper PTO control operation.

CAUTION: PTO units using transmission main pressure to engage the PTO gear must have a positive main pressure shut-off at the solenoid valve when the PTO is not engaged. Failure to provide this feature can cause inadvertent clutch apply and PTO damage.

4. Couple the PTO output to its driven equipment. Check couplings or universal joints for correct assembly and alignment. If the driven component is not a direct mount arrangement, check the PTO drivelines for angularity, phasing, and offsets.

6–7. CONNECTING PARKING BRAKE CONTROL

1. Connect and properly adjust the parking brake.
2. Adjust the brake shoe-to-drum clearance as specified by the manufacturer.

This does not apply to HD/B 500 Series (off- and on-highway) transmissions.

6–8. CONNECTING COOLER

Refer to Figure 6–1 for typical cooler port locations and torque values.

6–9. CONNECTING SPEEDOMETER DRIVE

The ECU, through the vehicle interface module (VIM), provides an electronic speedometer speed signal. Consult the original equipment manufacturer (OEM) for connection procedure.

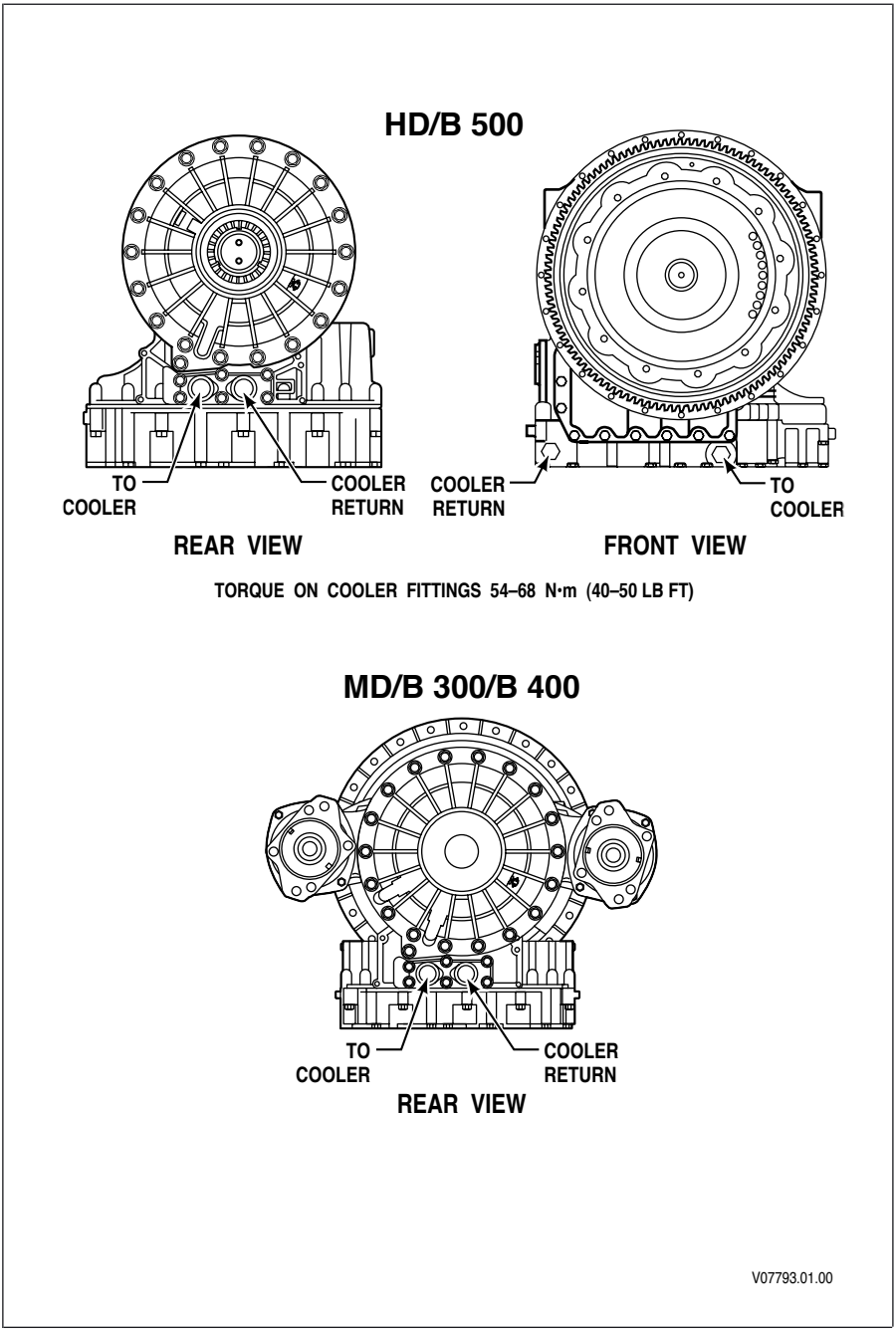


Figure 6–1. Torque Values of Typical Fluid Cooler Line Fittings

6–10. CONNECTING ELECTRICAL COMPONENTS

NOTE: The MD/HD Product Line electronic control systems are designed and manufactured to comply with all Federal Communication Commission (FCC) and other guidelines regarding radio frequency interference/electromagnetic interference (RFI/EMI) for transportation electronics. Manufacturers, assemblers, and installers of radio-telephone or other two-way communication radios have the sole responsibility to correctly install and integrate those devices into MD/HD Product Line transmission-equipped vehicles to customer satisfaction. For further information, refer to Allison Transmission publication number TS2470EN, MD/HD/B Series WTEC II Electronic Controls Troubleshooting Manual.

1. Remove the cover from the transmission feedthrough connector and carefully connect the transmission external wiring harness. Keep dirt and debris out of the connector.
2. Connect the external wiring harness.
    a. HD/B 500 — connect engine, turbine, and output speed sensors; retarder control connector; retarder temperature sensor; and accumulator solenoid
    b. MD/B 300/B 400 — connect engine and output speed sensors, retarder control connector, and accumulator solenoid.
3. Connect the PTO(s) connector(s). The PTO connector **is not** part of the Allison Transmission external wiring harness.
4. Tighten the transmission wiring harness external connector bolts to 2–3 N•m (18–25 lb inch).
5. Be sure the speed sensors, PTO connector, and other connections are securely seated and latched by pulling on the connector — NOT THE WIRES. On the MD/B 300/B 400, turn the retarder connector (if used) until feeling a positive snap on the connector.
6. The transmission has a sump fluid temperature sensor on the internal wiring harness. A retarder fluid temperature sensor is installed in the retarder on retarder-equipped models. Hot fluid conditions in the sump or retarder can be read with Allison DOC™ service tool by programming an output function. Refer to Allison Transmission publication number GN3433EN, Allison DOC™ for PC User Guide, for specific instructions.
7. A temperature gauge may be installed in the “To Cooler” line. Temperature gauge installations are available on integral cooler installations.

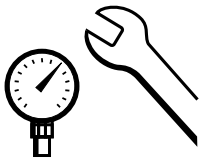
8. If equipped with a capillary tube and bulb:
    a. Tightened the adapter tight enough to prevent leakage.
    b. Install the bulb into the adapter and tighten the nut.
    c. Check the capillary tube for interference with other parts that might chafe or damage the tube. Long tubes may require support clips or brackets.
9. If equipped with a thermocouple, install the thermocouple and connect the leads.
10. Install and connect other electrical components such as heaters, winterization equipment, and pressure sensors.
11. If equipped, install the pressure gauge tube or line.
12. Be sure all unused hydraulic openings are plugged.

6–11. FILLING HYDRAULIC SYSTEM

- Select a transmission fluid (refer to Section 2–5, Fluid Recommendations, Table 2–5).
- Fill the transmission with the required amount of fluid (refer to Section 2–8, Transmission Fluid And Filter Change Procedure, Paragraph c. Refill Transmission).
- Run the engine for about one minute and check the fluid level (refer to Section 2–3, Transmission Fluid Check, Paragraph a. Electronic Fluid Check Procedure through Paragraph e. Consistency of Readings.

6–12. INSTALLATION CHECKLIST

Complete the Installation Checklist. Refer to Section 7–1, Installation Checklist.

Section VII	CHECKS AND ADJUSTMENTS	

7–1. INSTALLATION CHECKLIST

Use this checklist after transmission installation. As items are checked, mark them off this list.

Torque Values:

- All control module bolts: tighten to 51–61 N•m (38–44 lb ft)
- Breather: tighten to 12–16 N•m (9–12 lb ft)
- Control module pressure taps: tighten to 10–13 N•m (7–10 lb ft)
- Cooler hydraulic fittings: tighten to

  #12, 34–47 N•m (25–35 lb ft)

  #16, 54–68 N•m (40–50 lb ft)

  #20, 68–81 N•m (50–60 lb ft)
- Cooler port cover bolts: tighten to 51–61 N•m (38–45 lb ft)
- External harness-to-transmission connector bolt: tighten to 1–2 N•m (18–25 lb ft)
- Flexplate adapter-to-converter cover bolts: tighten to 24–29 N•m (18–21 lb ft)
- Flexplate-to-crankshaft hub bolts; consult engine manufacturer specifications
- Flexplate-to-flexplate adapter bolts: tighten to

  12–bolt design24–29 N•m (18–21 lb ft)

  6–bolt design51–61 N•m (38–44 lb ft)
- Fluid drain plug: tighten to 25–32 N•m ((18–24 lb ft)
- Fluid fill tube bracket: tighten to 24–29 N•m (18–21 lb ft)
- Speed sensor bolts: tighten to 24–29 N•m (18–21 lb ft)
- Output flange bolts: tighten to

  MD/B 300/ B 400 Series transmission—30–35 N•m (22–26 lb ft)

  HD/B 500 Series transmission—51–61 N•m (38–45 lb ft)

- PTO cover bolts: tighten to 51–61 N•m (38–45 lb ft)
- PTO mounting bolts: tighten to 51–61 N•m (38–45 lb ft)
- PTO pressure hose to transmission: tighten to 10–13 N•m (7–10 lb ft)
- Rear cover bolts: tighten to 90–110 N•m (66–81 lb ft)
- Throttle position sensor (TPS) to transmission bracket: tighten to 108–122 N•m (80–90 lb ft)

Cooler Fluid Lines and Air Hose for:

- No leaks
- Connection tightness
- Correct routing

Throttle Position Sensor for:

- Proper adjustment
- Correct routing of cable and harness

Driveline for:

- Proper indexing of universal joints
- Proper drive shaft angles
- Driveline backlash
- Lubricated universals and slip-joints

Hydraulic System for:

- Recommended fluid—TranSynd™, DEXRON®-III, or C4 fluid
- Correct fluid level in transmission
- Dipstick correctly calibrated (Figure 2–2)
- Fill tube tight
- Fill tube cap tight
- Breather clean and free of restrictions
- No fluid leaks during operation

Instruments and Electrical Equipment for:

- Proper wiring and electrical connections
- Instruments, gauges, and lights work correctly
- Shift Selector display is on and DO NOT SHIFT light is off
- Fluid temperature gauge

Power Takeoff (if installed) for:

- Controls connected and operative
- Correctly coupled to driven equipment
- Lubrication line correctly installed and routed, if used

7–2. ROAD TEST AND VEHICLE OPERATION CHECKLIST

NOTE: Refer to Allison Transmission publication number OM2157EN, MD/HD/B On-Highway WTEC II Electronic Controls Operator's Manual.

a. Driveability. Drive-away checks are performed to verify proper transmission and support equipment installation and operation. The following steps outline drive-away check procedures:

1. Check fluid—Fill the transmission with the appropriate fluid. Refer to Section 2–5 for fluid recommendations.
2. Start the vehicle—Check for proper system response during start-up.
   a. Turn on the vehicle's master/ignition switch.
   b. The **DO NOT SHIFT** light should come on.
   c. Start the engine.
   d. The **DO NOT SHIFT** light should go off.
   e. "NN" should appear in the shift selector display.

NOTE: Whenever a transmission has been overhauled, exchanged, or undergone internal repairs, the ECU **must be** "Reset to Unadapted Shift."

3. Clear Trouble Codes—During installation, it is common for "false" codes to be stored in the ECU. These codes **must be** cleared prior to road testing the vehicle.
4. Road Test the Vehicle—Allow the electronic control time to "converge" shifts.
5. Check for Proper Operation
   - Check all components for proper mounting and operation.
   - Check for transmission fluid leaks at gasket surfaces, lines, and hoses.

6. Recheck for Trouble Codes
   - Use the Allison DOC™ For PC diagnostic tool or shift selector to determine if codes were set during the road test.
   - Refer to Section 2–11, Troubleshooting, Paragraph c. Clearing Trouble Codes Using Shift Selector and Paragraph d. Retrieving Troubleshooting Codes.
7. Troubleshoot—If codes exist after the road test, problems **must be** found and corrected (Refer to Allison Transmission publication number TS2470EN, MD/HD/B Series WTECII Electronic Controls Troubleshooting Manual).

b. Service and Maintenance.

- Refer to Allison Transmission publication number SM2148EN, MD/B 300/B 400 Series On-Highway Service Manual, for detailed transmission service and maintenance instructions.
- Refer to Allison Transmission publication number SM2457EN, HD 4000/B 500 Series Automatic Service Manual, for detailed transmission service and maintenance instructions.
- Refer to Allison Transmission publication number TS2470EN, MD/HD/B Series WTEC II Electronic Controls Troubleshooting Manual, for detailed electronic system troubleshooting.

c. Road Test Checklist. Complete the following checklist.

Neutral Start Circuit:

- Starts only in **N** (Neutral)

Instruments:

- DO NOT SHIFT light and shift selector display
- Transmission fluid pressure gauge—if used
- Speedometer
- Temperature gauge—if used
- Reverse warning system—if used

Transmission Fluid:

- Fluid level meets specifications—cold, neutral, level
- No leaks
- Warm-up and check fluid level—hot, neutral, level

No-Load Governed Engine Speed:

- No-load governed speed of engine
- Adjust governor as necessary—refer to the manufacturer's specifications for the engine-transmission being tested.

Output Retarder:

- Operation of the output retarder, if installed, while descending a grade or slowing on a level road.

PTO—if installed:

- PTO operation—Refer to Allison Transmission publication number OM2157EN, MD/HD/B Series WTEC II Electronic Controls Operator's Manual.

Shift Sequence:

- Transmission upshifts and downshifts smoothly through all ranges

Other Checks:

- Stall test
- Shift quality

Comments:

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CUSTOMER SERVICE

Section VIII

8–1. OWNER ASSISTANCE

There are distributors and dealers around the world ready to stand behind every Allison Transmission product. Any situation that arises in connection with the sale, operation, or service of your transmission will be handled by the distributor or dealer in your area.

Refer to Allison Transmission publication number SA2229EN, Worldwide Sales and Service Directory, for a current listing of Allison Transmission authorized distributors and service dealers.

8–2. SERVICE LITERATURE

This service literature provides fully illustrated instructions for the operation, maintenance, service, overhaul, and parts support of your transmission. To be sure that you get maximum performance and service life from your transmission, you may order publications from:

SGI Inc.
Attn: Allison Literature Fulfillment Desk
8350 Allison Avenue
Indianapolis, IN 46268
TOLL FREE: 888–666–5799
INTERNATIONAL: 317–471–4995

Refer to Table 8–1, MD/HD Product Line Service Literature, for additional service literature.

Table 8–1. MD/HD Product Line Service Literature

Transmission Model	MD/B 300/B 400	HD/B 500
Automatic Transmission Fluid Technician's Guide	GN2055EN	GN2055EN
Job-Aid Cards	JA2506EN	JA2685EN
Mechanic's Tips *	MT2159EN	MT2159EN
Operator's Manual*	OM2157EN	OM2157EN
Parts Catalog*	PC2150EN	PC2456EN
Parts Catalog CD-ROM	CD2150EN	CD2456EN
Principles of Operation	PO2454EN	PO2454EN
Service Manual	SM2148EN	SM2457EN
Troubleshooting Manual	TS2470EN	TS2470EN
Worldwide Sales and Service Directory*	SA2229EN	SA2229EN
* Also available on the internet at www.allisontransmission.com		

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